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EDITORIAL.

Bark Reserves on Small Rubber Holdings.

Comparisons are frequently made between the consumption of bark on estates and small holdings, which generally result in the conclusion that the system—or lack of system—adopted by the latter leads to the removal of an excessive amount of bark, resulting in insufficient bark renewal and therefore subsequent excessive wounding; in the incidence of brown bast and other diseases and in fact, in a general lowering of the vitality and usefulness of the trees.

If the subject was as simple as this, Malaya would by this time possess a very large area of practically worthless native rubber holdings, whereas, in point of fact, recent statistics prove that the yields of rubber on such holdings continue at a high level. It would therefore appear desirable firstly, to readjust our ideas concerning the potential rubber production from small holdings and secondly, to devise a satisfactory means of arriving at a computation of the amount of bark consumption on such holdings.

Bearing in mind the present low price of rubber, one is apt to adopt the argument that the present high yields from small holdings are entirely the result of necessity—that the small-holder is compelled thereby to press for the production of every possible pound of rubber from his holding. While this is undoubtedly a fact, it is doubtful whether the present practice as indicated above is more harmful than the previous arrangements usual with small-holders, which are at the moment less practised than during periods of high prices, such as the system of leasing the holdings for a period of years, which induces the lessee to press for the production of the highest yields possible; or the very common arrangement whereby the tapper takes half the crop in lieu of wages. Again, while during times of depression the owners of such holdings undoubtedly press for high yields to counterbalance the low prices and thus to obtain sufficient money for the necessities of life, it must not be forgotten that there is a decided inducement for heavy tapping when prices are high. Our view therefore is that the general policy of the small-holder is in the direction of heavy tapping whatever be the condition of the market, and it remains, in view of the desirability of forming a judgment concerning the future of such areas, to estimate the prospects of such holdings by a measurement of the amount of bark consumed.

Whereas the general policy on estates is the maintenance of a limited number of trees per acre in a high state of efficiency, the small-holder has adopted the system of planting a large number of trees per acre and of tapping such of these trees as will yield an appreciable amount of latex. In practice, therefore, the small-holder has a large proportion—variously estimated up to 50 per cent.—of his trees out of tapping. In other words, he is always resting a number of trees and can afford to do so because the system still leaves a number of tappable trees.

Another point of difference between estates and small holdings is that of cultivation. The usual practice on large estates until comparatively recently was clean weeding and even now considerable areas of mature rubber exist in this condition. The system has undoubtedly led to the reduction of fertility by reason of soil erosion and loss of humus. Small-holders, on the other hand, have almost invariably neglected weeding and general cultivation and have therefore retained their soil. Soil retention has been further assisted by the large stand of rubber trees.

Some of the factors which affect bark consumption on rubber owned by small-holders have been indicated above. It will be realised that while good estate practice allows for the removal of about an inch of bark monthly, the small-holder removes about two inches in the same period, but in view of the fact that many of his trees are out of tapping, the average amount of bark removed per month more nearly approximates to the estate results.

The subject of bark reserves on small holdings has been raised by the Rubber Growers' Association and was considered at the Second Inter-departmental Agricultural Conference held at Kuala Lumpur in October last. The problem of evolving a satisfactory system for obtaining, regularly, information on bark reserves was discussed at some length during which the practical difficulties to be overcome were emphasised. This discussion resulted in the appointment of a committee to consider the question further and to decide how far some scheme for obtaining reliable data of the yield, bark consumption and bark reserves on small holdings, was desirable and possible.

If the deliberations of this committee lead to the establishment of suitable means of achieving these objects, a decided step in advance will have been taken to perfect statistical data upon which can be based an appreciation of the future prospects of production.

Spices.

Attention is drawn to the spice industry in Penang and Province Wellesley by the publication in this number of two articles bearing on this subject. The spice industry in this country has languished for many years, partly owing to the popularity of rubber planting, and partly no doubt, owing to the damage suffered by the trees in the past on account of pests and diseases against which efficient control measures were not known.

At one time Penang provided the world with nutmegs of the highest quality on the market and although at the present time but a small quantity originates

from this source yet the term "Penang nutmegs" is still used to designate the best quality product. A revival of the industry would be assisted by this commercial asset, and in the light of the greater knowledge which exists on the cultivation of the tree and the control of pests and diseases to which it is prone, we can see no good reason against the re-establishment of the industry.

Stock Feeding. The stock breeder of to-day realises that nutrition is not merely a matter of digestion and assimilation, but that vitamins play an important rôle and minerals exercise a considerable influence on the development, health and vigour of animals.

In the *Malayan Agricultural Journal* published last November will be found an article by Dr. T. B. Orr on "The Role of Vitamins in Stock Feeding." This article should be read with the article included in the present number on "Minerals and Nutrition" by Lt. Colonel H. A. Reid O.B.E. These two articles sum up present day knowledge on these important aspects of stock feeding.

Lt. Colonel Reid for some years held the appointment of bacteriologist and pathologist to the New Zealand Department of Agriculture and has devoted considerable attention to the questions which provide the subject matter of his valuable contribution to this Journal.

Original Articles.

THE CLOVE AND NUTMEG INDUSTRY IN PENANG AND PROVINCE WELLESLEY

BY

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Introductory.

Much has been written concerning the spice industry in the East Indies, particularly by H. N. Ridley, in his book on "Spices" published in 1912. In older publications is found detailed information by the same author, (*Agricultural Bulletin of the Malayan Peninsula* 1897), and also by Oxley in "The Journal of East Indian Archipelago" and in a paper printed in Logan's Journal in 1848. The object of this article is merely to outline past history, touch briefly upon cultivation, and conclude with a few notes concerning the position of the industry to-day.

History.

Comparatively few people of the present generation in Malaya realise what an important factor the spice industry was to the island of Penang seventy years ago. The nutmeg was known as a spice as early as A.D. 540, and appears to have found its way into Europe through Aden towards the end of the twelfth century. The earliest record of cloves appears to be in Chinese books dating from 260 B.C. to 220 B.C. wherein it is stated that officers of the court were required to hold cloves in their mouths when addressing the Sovereign. From the eighth century cloves were imported into Europe but were very costly, being valued in 1265 at from 10 shillings to 12 shillings a pound.

The Portuguese held the monopoly of both cloves and nutmegs while in possession of the Spice Islands till 1605 when they were expelled by the Dutch. The latter attempted to confine their cultivation to Banda and Amboyna. So much spice did they accumulate in the early years of their occupation that it is on record that a large quantity was burnt in Amsterdam in 1760 to keep the price up.

On the founding of Penang in 1786, by Captain Light, the East India Company took steps to break the Dutch monopoly by sending a botanist named Smith to the Moluccas to obtain plants of cloves and nutmegs. Captain Light

had already obtained clove plants from Mauritius, but all these are said to have died. In 1800 Smith sent some 5,000 nutmeg and 15,000 clove plants to Penang which were planted in a spice garden established by the East India Company. From this garden were established quite a number of European plantations of some size. In 1805 the spice gardens contained 5,100 nutmegs, 1,625 clove trees and 1,050 seedlings, when the gardens were sold for \$9,656/-. In about 1850 there were reported to be upwards of 30 spice plantations in Penang and Province Wellesley. The largest of these contained 20,000 trees, the total number of trees in all plantations was stated to be about 80,000 and the gross annual produce was estimated at 130,000 lbs. At this time there were over 24 plantations in Singapore containing 55,925 nutmeg trees of which nearly 15,000 were in full bearing giving a return of over four million nutmegs a year. In 1860 there were 14,500 acres under spices in Penang and Province Wellesley yielding 30—40 pounds per acre. But in that year came the first blow to the industry in the nature of what was termed the "nutmeg disease," which was so destructive as nearly to wipe out the cultivation in Penang and Province Wellesley and in fact did stamp out the plantations in Singapore. Ridley states that there is little doubt that this "disease" was due to attacks by a Scolytid beetle, *Phloeosinus cribratus*. He bases his assumption on a description of the disease by Surgeon Collingwood, but there was no entomologist in the Colony at the time so the position appears doubtful. This beetle has not been observed doing any considerable damage to nutmeg trees during the past five years in which the plantations have been under the observation of the writer, but Gater, in a report dated January, 1924, is of opinion that this insect should be looked upon as a serious pest which, for the time being, is quiescent.

In Penang and Province Wellesley the Chinese, chiefly Khehs, re-started the cultivation of nutmegs and cloves but before it again became well established the introduction of rubber into the country placed the cultivation of spices well in the background, with the result that one now rarely finds a plantation of nothing but spices, they have invariably been inter-planted with or replaced by rubber.

Ridley, writing in 1897 says "Good plantations can also be seen in Malacca (at Pringgit), and in Johore (at Pengerang) and in a few other spots," but as far as is known these plantations have mostly, if not all, disappeared.

Description.

Nutmegs and mace are the products of *Myristica fragrans*, a bushy tree sometimes attaining a height of forty feet. The flowers are yellow in colour, and male and female flowers are, as a rule, on separate trees. Pollination is effected by small insects. The fruit takes nine months to ripen, and is in appearance rather like a peach. It has a thick fleshy pericarp or husk which splits when the fruit is ripe showing the dark brown seed which is covered with a network of bright crimson, known as the mace. Between the nutmeg and the mace is a thin brittle shell; this shell is not usually removed before export

but the seed is dried whole after the removal of the mace, which is dried separately. The Malay name for this spice is "pala," the mace being known as "bunga pala."

The cloves of commerce are the dried unopened flower buds of a tree, *Eugenia Caryophyllata*, Thunb. It is a smaller tree than the nutmeg, only reaching a height of 20—30 feet. It is of a symmetrical conical shape, and very picturesque with its bright green shiny leaves which are very aromatic especially when crushed or bruised. The flowers appear in bunches at the tips of the branches. The fruits have a fleshy pericarp and when ripe are rather like a ripe damson in colour and size but are oblong in shape; they are often referred to as "mother cloves."

The Malay name for this spice is "bungah chengkeh."

Soils and Situation.

Both nutmegs and cloves seem to thrive best in the usual yellow, loamy clay found on the hills of Penang and at Bukit Mertajam in Province Wellesley; the more friable the soil the better the trees seem to thrive. It is stated by Oxley that the deeper the tinge of iron in the soil the better the plants seem to grow. He quotes the hard ferruginous gravel found at Pringgit in Malacca where the two spices once thrived remarkably well. The slopes of Penang hills and Bukit Mertajam are in places exceedingly steep but are broken up by granite rocks which prevent soil wash to a considerable extent; the usual practice is, however, to build up terraces by making small walls of granite boulders, which are readily available, and filling them up with earth, this serves to support the trees and to prevent soil wash.

In Penang and Province Wellesley cloves and nutmegs are generally cultivated on hills from 200 to 2,000 feet above sea level and are rarely seen on the plains, although it is said that cloves will thrive at lower attitudes provided the water table is well below the surface. It is interesting to note that at Bukit Mertajam in Province Wellesley, where every available space was once planted with nutmegs and cloves, the limit of cultivation was reached at under 1,000 feet, above which the trees would not grow. It is often said that nutmegs and cloves must be grown within sight and sound of the sea; this may be an important factor as it is very noticeable that on Bukit Mertajam hill the spices are only planted on the side facing the sea, and also that on Penang hills the best plantations are to be found on the slopes facing the open sea to the West. It is also interesting to note that few, if any, successful plantations have been established at any distance from the sea.

Cultivation.

In the case of both nutmegs and cloves, plants are raised from seed in beds under shade. The seedlings are transplanted when about six inches tall. Nutmegs are planted about 30 feet apart, while cloves should not be planted less

than 20 feet apart. Cloves are very sensitive to water at the roots and any possibility of water collecting in puddles round the young plants must be avoided.

Manuring is an important item with both nutmegs and cloves and has always received much attention from keen growers. The usual form of manure in Penang and Province Wellesley is fish refuse but, when obtainable, prawn dust is preferred. This is the refuse from the manufacture of the well-known Malay condiment "belachan." Manure is applied once a year, usually in a trench dug round the tree following the spread of the branches. A favourite practice amongst the Chinese on Bukit Mertajam is to dig a trench two or three times a year and to fill it with cut "lallang" grass.

Clove trees begin to bear when six to seven years old. Nutmegs do not bear until the seventh or eighth year and sometimes later.

Collection and Preparation.

Nutmegs are picked by hand as soon as the fruit splits or is about to do so. They may also be picked with the aid of a forked stick by twisting the fruit off the branches. In Penang and Province Wellesley, where large quantities are rarely handled, the seed is removed from the husk and dried in the sun. The testa or shell is not removed before drying and a nutmeg is said to be dry when the kernel rattles in its shell. The shell is often left intact for export as its removal exposes the kernel to attack by a small beetle. The mace, which is removed with the husk, is dried separately on mats in the sun. When dry it should be flat, horny in texture and of a good colour.

Cloves are picked by hand, but the trees are often of such a height that a light bamboo ladder has to be used to reach the topmost branches. Cloves are fit for gathering when the flower bud begins to assume a reddish colour but before the bud breaks and the small white petals have expanded. The unopened flower buds are then roughly picked over and dried in the sun. The greatest care is necessary in handling the cloves, particularly as they become dry, since the "heads" very easily become detached and not more than 5 per cent. of headless cloves is allowed in a sample of first quality. In a good sample the cloves are large, not too wrinkled and a light purplish brown in colour. Too rapid drying causes them to become shrivelled and brittle. Cloves lose about 70 per cent. of their weight in drying.

Marketing.

In the case of both cloves and nutmegs, the grower usually sells his crop on the tree to a local Chinese dealer who picks, dries and grades the product, and sells to the exporter. The growers appear to be satisfied with existing conditions. The cloves are collected on the land, paid for immediately, if not beforehand, the grower being relieved of the worry of careful drying, sorting and transport to town. Their satisfaction may be due either to the knowledge that they are well served by the dealers, or to conservatism, possibly both. Efforts have been made

from time to time to encourage co-operation amongst the growers with a view to improving their returns but this has met with little success. Nutmegs are valued according to size and are therefore graded according to weight.

No. 1 Grade gives 60—70 nuts to the pound.

No. 2 „ „ 75—100 „ „

No. 3 „ „ 100—150 „ „

Conclusion.

The cultivation of spices on Penang hills and at Bukit Mertajam, which was once a flourishing industry, has dwindled to a few small plantations here and there, chiefly owing to the greater attraction of rubber, and in the case of cloves to the incidence of a stem borer, which causes widespread damage and is difficult to control. The small supplies of nutmegs and cloves which are available are absorbed almost entirely by India. Business with Europe is almost dead, killed by the competition of West Indian nutmegs and mace, and of Zanzibar cloves, although the latter are known to be inferior to those produced in Penang. In 1926 Penang cloves on the London market were fetching 2/6d. per lb. while Zanzibar cloves were only fetching 1/2d. per lb. Uncertainty of the market is a factor which the dealer has to contend with, buyers are often difficult to find even at a low price. The chief demand for cloves is for the Christmas market, this means that there are very few buyers, say, after October. It is a common practice for exporters to buy in April and be unable to sell in London or elsewhere until October. It is a fact, however, that when the price of rubber reaches a low level considerable activity is seen in spice plantations, attention is given to cultivation, manuring, and even planting of young clove bushes to replace some of the very poor rubber trees to be seen on the slopes of Penang hills.

Literature Cited.

Ridley. Agricultural Bulletin of the Malay Peninsula 1897.

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Oxley. Journal of East Indian Archipelago.

Oxley. Logan's Journal 1848.

TWO IMPORTANT PESTS OF THE CLOVE TREE

BY

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The following paper, which is based on observations and reports made by Officers of the Entomological and Field Divisions of the Department of Agriculture, has been prepared with the object of collating all available information regarding two pests; one a beetle, the other a moth, which are said to be responsible for a considerable reduction in the clove crop of Penang Island and Province Wellesley.

In 1923, attempts were made to revive the industry and during inspections of the clove trees the presence of a beetle borer was revealed for the first time by F. Birkinshaw, Agricultural Field Officer, Perak North.

The moth borer which was re-discovered by the writer in 1928 was apparently first noticed by Ridley, who in the Agricultural Bulletin of the Malay Peninsula 1896, when dealing with diseases of the clove tree states:

"At Penara Bukit (Penang) I found a number of clove trees perishing from the attacks of a borer. The borer is a caterpillar of a moth which I hope soon to rear.

It is black with yellow rings, about $1\frac{1}{2}$ inches long and covered with rather sparse long hairs. The caterpillar usually bores into branches, more rarely into the main stem and tunnels up the centre eventually killing the branch. Two or three may occur in one branch. The entrance to the burrow is protected by a web enclosing small pellets or excreta. The pest seemed very destructive, though the Chinese seemed to consider the loss of a few branches of little importance. In several trees they had cut the caterpillar out, evidently recognising the nature of the plague. Hacking the tree about in this way is of course very injurious. The best method of dealing with the animal would be to pass a thin wire up the hole into the burrow and so spear the caterpillar. There is not much difficulty in doing this as the burrow is usually straight and not very long and is quite clear of the excreta, which, as previously mentioned are ejected at the mouth of the hole. The smaller boughs affected should be cut off and burnt."

In 1928, the writer was able to secure a few larvae of this moth, which, judging by their habits, presumably belong to the family Arbelidae. From these larvae he was successful in rearing a few adults, some of which have been submitted to the Imperial Institute of Entomology for determination.*

The presence of a larva is brought to notice by the dark stains and the mass of silken webbing containing a large quantity of drying frass adhering to the affected branch. This webbing conceals the entrance to the burrow and is used by the larva as a protective covering under which to feed. The main food of

*The identifications of both insects dealt with were received after the paper had gone to press.

The Cerambycid is *Chelidonium brevicorne* Schwarzer. The moth borer, which belongs to the family Xyloryctidae, has been named as *Paralecta antistola* Meyrick.

the larva is bark, and feeding is carried out at night. During the day the larva returns to the burrow, which it would seem, it constructs solely with the idea of providing a safe retreat. The entrance to the burrow is usually situated between the forks of branches measuring from one half to one inch in diameter (Fig. 5).

* The larva (Fig. 1) is black with a pale yellowish stripe on the back of most of the segments and the pupa (Fig. 2) is light-brown and about five-eighths of an inch in length.

The adult male moth (Fig. 3) measures one and a half inches across the wings and is entirely sooty brown, except for a pale greyish transverse band along the inner half of the forewings.

The female moth (Fig. 4) is entirely whitish with a faint pinkish tinge and iridescence. On the forewings there is a central brown spot and a brownish shading at the tips. The hindwings are rather strongly shaded with brown. Across the wings it measures two inches.

Attempts to rear the larvae were not very successful, and the sole information obtained regarding its life cycle is that the pupal period lasts for twenty-one days.

The boring habits of this species bring about die-back and also, as vacant bore holes are capable of holding rain water, decay sets in lower down.

The grub of the beetle borer (Fig. 6) was first brought to light in January, 1924, by B. A. R. Gater, late Assistant Entomologist, Department of Agriculture, S.S. and F.M.S., who undertook the initial investigations.

In the same year, he carried out control experiments, consisting of the injection into the bore hole of various chemicals. Artificial bore holes were also made in healthy trees, in order to ascertain whether any deleterious effects were produced by the injection of the chemicals employed.

According to Gater, the time taken for a complete life cycle from egg to adult is about a year, the egg being probably laid in May and pupation taking

*1. Description of larva.

Head black, glabrous: strongly punctate; labrum and antennae pale shining brown. Thoracic segments blackish brown; prothoracic shield dark shining brown, with a faint median longitudinal pale brown stripe; meso and meta thorax with shining light brown chitinated patches; metathorax with a narrow transverse ochreous band dorsally.

Abdominal segments 1—7 light purplish brown with an ochreous band along the anterior margin dorsally, behind which is a chitinated shining brownish patch; abdominal segment 8 with an ochreous band only; segments 9—10 blackish brown; segments 1—7 with irregular shining brown chitinated patches laterally. Head and body with scattered setae and with a seta above each spiracle. Thoracic legs shining brown. Abdominal legs with the crochets pinkish.

Description of pupa.

Pupa 15 mm. Region of head dark brown, becoming paler towards elytra; ventral surface pale yellowish brown. Ventral segments with an undulate ridge of spines which hardly reach the spiracles on segments 1 and 2, and completely encircle the segment in segments 3—6. Surface of head region finely tuberculate and with four large tubercles each bearing a seta which is curved forward to about half its length. Prothorax with four pairs of setae: sides of head with a strongly chitinated process; spines on segments 1 and 2 of abdomen acute, on remaining segments short and rounded apically (N.C.E.M.)



FIG. 1. LARVA OF MOTH BORER.
NATURAL SIZE $\frac{3}{4}$ ".

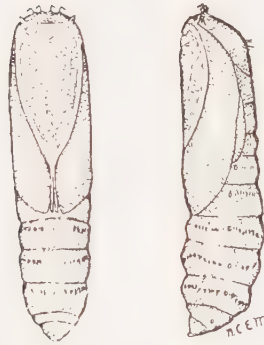


FIG. 2. PUPAE OF MOTH BORER.
NATURAL SIZE $\frac{3}{8}$ ".



FIG. 3. MOTH BORER ♂
NATURAL SIZE $1\frac{1}{2}$ ".



FIG. 4. MOTH BORER ♂ NATURAL SIZE 2".

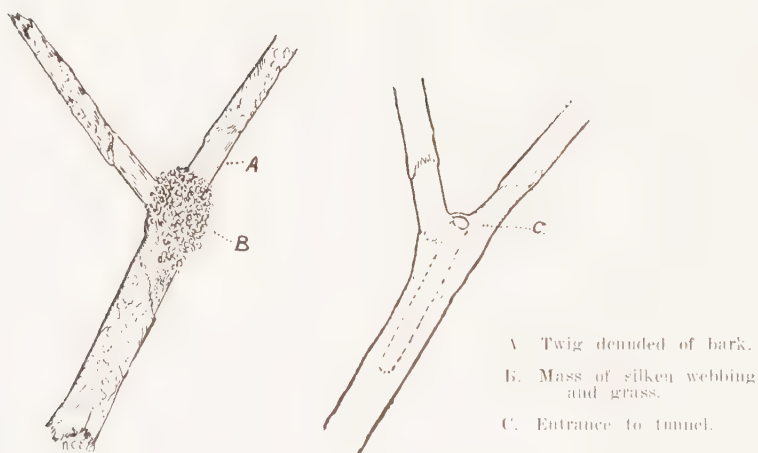


FIG. 5. CLOVE BRANCH SHEWING DAMAGE CAUSED BY MOTH BORER.



FIG. 6. GRUB OF CERAMBYCID.

place about February.

The grub of this beetle is dirty white, cylindrical with the anterior part of the body—i.e. that part nearest the head much enlarged. For this reason grubs of these beetles are sometimes known as "roundheaded borers."†

Six chemicals, namely dichlorobenzene, tetrachlorethane, dinitronaphthalene, tetra hydronaphthalene, creosote-chloroform mixture, and trichlorethylene were used by Gater, with apparently no deleterious effect on the trees. Grubs, however, in every instance were killed by these injections.

Control methods practised by the cultivators were clumsy and liable to cause considerable damage to the trees. The method adopted by them consisted of cutting away a portion of the tree around the bore hole and extracting the grub by means of a piece of wire bent at the end. It is obvious that irreparable damage may be inflicted in this manner.

The clove areas at Bukit Mertajam, Province Wellesley and at Balik Pulau and Teluk Bahang, Penang, were inspected by C. Dover, late acting Assistant Entomologist and F. R. Mason, Agricultural Field Officer, in June, 1927.

The conclusions arrived at by those officers were that, while it would seem that little or no harm can result from the injection of chemicals, it is essential that adequate precautions be taken to inhibit further infestation of the trees by borers.

These areas were visited by J. W. Jolly, Agricultural Field Officer and the writer in May, 1928, but extended observations could not be carried out. At that time, the plantations were in a neglected state, and the ground was littered in places with dead branches. Dead clove trees had also been left standing. Larvae of the Cerambycid and of the Arbelid were found, but the former did not survive under laboratory conditions. Recommendations for control additional to those made by previous investigators, were not then made, for it was considered that until more complete information regarding the life history and possible alternative host plants of the insect were obtained, little progress could be made towards control.

Judging by the egg laying habits of other Cerambycidae it would seem that this species also lays its eggs on or just under the bark of the host tree. Therefore, the main object of any control measure should be to prevent egg laying. This could most probably be effected by treating the trunks and lower branches with a wash composed of whale oil and crude carbolic acid. Wrapping the trunks

† *Description of Grub.* Whitish ochraceous. Prothoracic shield pale brownish ochraceous in anterior half and laterally, whitish with a faint violaceous suffusion in posterior half; anterior half fairly thickly covered with short rather robust brownish setae, some arising from low tubercles. Head whitish ochraceous; Clypeus and anterior area of genae brownish ochraceous; mandibles piceous; palps and antennae dark brownish ochraceous. Thoracic and abdominal segments sparsely covered with short brownish setae, but smooth dorsally and ventrally except prosternum which is feebly setose. Thoracic legs brown. Spiracles light brown; posterior half prothoracic shield longitudinally striate. (N.C.E.M.)

with sacking treated in this way would probably be equally if not more effective, and would certainly tend to retain the solution for a longer period.

The destruction of larvae by chemical means can only be considered a temporary measure and until accurate information is obtained as to the extent to which trees will withstand the action of chemicals injected into them and the degree to which bearing is affected, prevention of infestation should be aimed at, after destruction of larvae already in the trees.

The question of damage to the clove trees in the same area was again considered in July, 1930, and visits of inspection were made by H. T. Pagden, Assistant Entomologist and F. R. Mason, Agricultural Field Officer.

In the report made subsequently, Pagden states that as far as he is able to ascertain, the Cerambycid borer has almost completely destroyed the clove industry at Bukit Mertajam.

In this area, the cultivators have given preference to rubber growing, and also have not replaced clove trees which have died as the result of borer attack and of the crude methods for control previously referred to in the present paper.

Pagden concludes that he is led to suppose that only trees which have reached a certain diameter are attacked by the Cerambycid, and "that careful attention to cultivation, pruning and the use of a deterrent wash in areas recently planted should eliminate damage by this pest."

In a later report he outlines the ideas held by Chinese clove growers with respect to the habits of the Cerambycid and the period during which attempts at control are practised.

A Chinese questioned on this subject stated that inspection is carried out between the "5th to the 10th month,"* since it is believed that it is during those months only, that the larva is to be found. The adult beetle was stated to bore a hole into the tree and enter this for the purpose of reproduction, but this procedure had not been observed. What happened after this would appear to be somewhat indefinite, the adult beetle either turning into a larva, or laying eggs in the tunnel it had previously bored. In the opinion of Pagden the Chinese would appear to believe the former since they do not seem to associate the smaller larvae with the larger. Other cultivators are inclined to the belief that the borers owe their origin to spontaneous creation.

Regarding the application of tar to cut surfaces where branches have been sawn off, the objection has been raised that this prevents the wound from drying quickly. According to Pagden's observations, however, this is wrong, as cut and untreated surfaces examined by him were seen to be attacked either by termites or by ants which make nesting galleries and possibly cultivate fungi.

In conclusion, pending detailed investigation into the ecology of the two pests, steps should be taken immediately to carry out the recommendations made by various officers.

* Chinese Calendar.

These recommendations may be summarised as follows :—

- (1) Careful pruning. Cutting off smaller infested boughs. (i.e. those infested by the Arbelid).
- (2) Treating all cut surfaces with tar, or some similar substance.
- (3) Destroying larvae by injection of chemicals into the bore holes.
- (4) Prevention of infestation by the application of washes.

The importance of co-operation in the practice of control measures should be stressed on all occasions.

PREPARATION OF SHEET RUBBER

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The preparation of sheet rubber has already been the subject of such a mass of literature that the publication of an article with the above title demands an explanatory foreword.

On account of the somewhat catastrophic changes which have recently occurred in the plantation industry, and the consequent readjustment of previously accepted standards, it is essential to be sure of the basic facts governing the manufacture of plantation products and therefore, even at the risk of reiteration, those responsible for future progress must make certain that principles are clearly defined.

The plantation in bearing is a factory and the manager is a manufacturer who must continually bear in mind the salutary fact that ultimate success depends on the quantity, quality and cost price of the product which he *sells*. It may be obvious, but it appears to be opportune to remind ourselves, that the reputation and livelihood of the dairyman depends upon the quantity and quality of the milk he sells and not on the size and vigour of his herd.

To ensure sales our product must conform to market requirements. It is with a view to balancing total sales against total cost of production that our plantation factories must be governed. The F.O.B. of a portion of the crop is of little significance in the economic structure of the whole plantation.

In the past the grower had the advantage. That which he chose to prepare the market was obliged to accept. In the course of time, however, the standards governing the preparation of plantation rubber have been gradually changed to meet the more pressing demands of the consumer, and at the present condition of the market the care and attention required to prepare Singapore Standard Quality sheet demands efficient and experienced supervision.

With increasing production and enhanced competition it is obvious that present methods and standards will be superseded and the preparation of plantation rubber will develop into a technical manufacturing process.

A time will come when the quality of plantation rubber will be judged by more scientific methods than those in fashion now and criteria based on the ultimate application of the commodity will regulate the estate plantation manufacturing process. For the present and immediate future, however, it is the Singapore Standard which is the real criterion and therefore it is by this standard that we sellers must fashion our product.

Singapore Standard Quality demands that "Standard ribbed sheet rubber shall be clean, tough rubber, free from bark or sand, from dampness, under or

over smoked or massed sheets." Our object must be to adapt our method of manufacture to fulfilling these requirements with the greatest economy.

The preparation of sheet rubber may be considered in four stages: viz., Collection of latex; coagulation; handling coagulum, and drying and packing.

Latex Collection.

Immediately latex exudes from the freshly opened cut there is a natural tendency for it to collect dirt and undergo change. Contamination commences at the tapping cut from the micro-organisms present in the air and on the tree and the small pieces of bark and vegetable tissues which have been washed down the cut by the latex and also particles of soil which were adhering to the tapping panel. There may be vegetable waste and soil in the tapping cup, also pieces of old partially putrefied rubber from the previous day's tapping. Under the present methods of tapping and collecting latex much of this contamination is unavoidable, but there is some which, even by present standards, is inexcusable.

In order to obviate unnecessary difficulties in cleaning the latex it is advised that precautions should be taken to prevent as much contamination of the latex as possible while it is flowing down the cut and collecting in the cup. It is realised that the sand and other forms of dirt can be removed subsequently but there is no reason why latex with a reasonable degree of cleanliness should not be collected, and the frequent sight of dirty cups which one meets in this country even on first class estates is a sad reflection on the attitude of mind of those responsible for the quality of plantation rubber.

When the cups are collected the tappers should also bear in mind the need for maintaining cleanliness and, although the system of wet collection which was practised some time ago is considered to be unnecessary, it is felt that recently washed buckets provided with well fitting lids are an undoubted advantage.

The use of a preservative in the field is open to much discussion and undoubtedly the field use of a chemical is difficult to control under ordinary routine conditions of tapping. If latex is collected early and cups and other vessels are kept reasonably clean there is little doubt that the use of a preservative in the cups is not essential. When the preservative should be added is into the tappers' buckets when the collection is to take place.

The Information Cards published by the Rubber Research Institute give particulars of the amount of sodium sulphite normally used. It is not considered that these proportions are absolutely infallible, however, and the estate manager should realise the necessity for carrying out his own trials from time to time to ensure the most economic and efficient use of preservative.

One frequently learns in dealing with estate queries that the appearance and quality of the sheet has suddenly changed. The manager will state that no alteration whatever has been made in his procedure and the use of preservative has remained unchanged; yet fate has suddenly dealt a cruel blow in the alteration of the appearance of his product. It must be realised that the rubber tree, like every other living organism, is subject to natural variations and these

variations will be reflected in the composition and behaviour of the latex; therefore, it is little wonder that a practice which has been found satisfactory at one time will, without doubt, need revising as the seasons change and the tree adjusts its metabolism. For this reason frequent periodic tests must be carried out so that the process of sheet manufacturing can be adjusted to meet the latex variations.

Latex Handling.

When the latex arrives at the factory, whether it has been transported in the tappers' buckets or in a collection cart, means should be provided for checking the quantity, strength and stability of the latex received, with suitable provision for handling the crop without delay. Strict uniformity in the procedure of crop reception and handling should be enforced with meticulous care.

Immediately the latex has been received at the factory, a sample should be drawn to see that it is satisfactorily preserved, and on the results of this sampling sufficient preservative can be added, if necessary, to allow for subsequent handling of the latex.

At the present time there is little doubt that particular attention is being paid by the market to the presence of sand and specks in sheet. The Rubber Research Institute has carried out sufficient work on this problem to be able to state very definitely the means whereby latex can be satisfactorily cleaned to make sheet rubber which will be entirely free from sand and specks. The cleaning cannot be effected by sieving alone, that is absolutely definite. Although there are many estates which have never yet resorted to settling diluted latex before passing it to the coagulating tanks and estates which continue to get standard prices for their sheet prepared from latex which has suffered only a very sketchy form of sieving, yet the Institute is fully convinced that such a state of affairs will not endure and future practice will necessitate a satisfactory cleaning of the latex before coagulation takes place.

Latex can only be cleaned satisfactorily by settling. When field latex is received it contains so much rubber—4 lbs. and more per gallon—that it is viscous and thick, therefore, any particles of sand or bark which happen to be present are prevented from separating. Separation can, however, be effected by a short period of settling if the viscosity of the latex is reduced with water. This can be accomplished in the factory by the use of settling tanks. In some cases old wooden coagulating tanks have been converted to this purpose. If sufficient money is available it is preferable to build suitably designed settling tanks of concrete, lined with tiles, or to purchase aluminium tanks. The tank should be constructed with an outlet near the bottom from which the latex can be run off without disturbing the separated sediment. If a quarter of an inch clearance is allowed between the outlet and the bottom of the tank, this will provide sufficient room in which the sediment can collect and remain undisturbed when the latex is run out.

The field latex should be poured into the settling tank through a coarse strainer, 40 holes to the inch, an ample supply of water being directed on to the

bottom of the sieve to obviate the necessity for manual assistance. The diluted latex will readily pass through the holes of the sieve and the coarse debris will be eliminated. The latex and water should be mixed in the settling tank so that the dry rubber content of the total bulk should not be more than a 2 lbs. of rubber to the gallon. The viscosity of this diluted latex will be sufficiently reduced to allow free separation of the light particles of barky material. These will rise to the surface and any particles of sand will settle to the bottom. When the diluted latex has been allowed to settle for ten minutes the contents of the settling tank should be very carefully skimmed. For this purpose a fine mesh sieve should be used—one having 100 holes to an inch would be preferable.

The skimmed latex should be run slowly from the settling tank to the coagulating tank, if necessary through an 80 mesh sieve in order to eliminate any small particles of scum or floating debris which have escaped the skimming. At this stage care should be taken to prevent the latex from running off too quickly or dropping too far in the course of its flow.

Frothing is very liable to occur in latex and the bubbles of air enclosed may eventually lead to defective sheet, besides hampering the rapid working of the factory.

Coagulation.

Coagulation of the standardised latex needs little comment. The proportion of acid to be used and the dilution recommended have been repeatedly specified. At the present time the Information Cards issued by the Institute set out in a concise manner the proportion of coagulant recommended for a variety of latex concentrations destined for sheet manufacture on the same day or on the following day.

A word about coagulating vessels would not be out of place. There is a tendency on the part of those responsible for the management of estate practice to overlook the organic nature of the fluid which they are handling. Latex is similar to milk and the behaviour of the two fluids bears a striking resemblance in many respects. The dairyman knows full well that his product will suffer unless the utensils he uses are maintained in a state of scrupulous cleanliness. At the present time the plantation factory is not required to conform to bye-laws established by a Department of Hygiene and the degree of cleanliness essential in handling milk is not legally enforced for latex. Nevertheless, if we are to prepare a reasonably uniform product, free from defects penalised by the market, we must pay attention to cleanliness in the factory and guard against all sources of contamination and putrefaction.

The use of aluminium coagulating tanks and other factory utensils assists in maintaining such cleanliness, but where aluminium is too costly it does not follow that we should relinquish our care. Wooden tanks can be kept perfectly sweet and clean. Tanks and their wooden partitions should be washed with clean water after each coagulation and then dried before being filled with latex again. Where a factory is called upon to handle an increasing crop it is sometimes found

that the limited capacity of the coagulating plant entirely prevents any effective cleaning and drying of the tanks from one day to the next. This invariably leads to trouble, for it is humanly impossible to maintain tanks and partitions in a satisfactory state of cleanliness if they are in constant and continuous use. There must be an adequate capacity to allow each tank to be thoroughly cleaned and dried at regular intervals. Where tanks have already become sour, and bubbles in the sheet will very soon draw attention to this, drastic steps must be taken to eliminate all the putrefactive organisms which have developed in the pores of the wood. Boiling with water to which a little para-nitrophenol has been added will be found most effective but scouring with other types of bactericides and subsequent drying will also serve. As it is becoming increasingly common for the crop to outgrow the capacity of the factory plant, troubles which arise from inadequate cleaning are becoming more prevalent.

The crop capacity of coagulating tanks depends on the concentration of the latex at the time of coagulation and it may not be out of place to remind those who are still struggling through each day's crop in the form of latex diluted to $1\frac{1}{4}$ lbs. dry rubber content per gallon that latex containing 2 lbs. dry rubber per gallon is being handled daily in more than one factory which is never awarded less than Singapore standard for its sheet. The treatment of the more diluted latex is possibly more fool-proof and that is probably why estates still continue to dilute their latex to such an unnecessary extent, but when one considers that the adoption of "two pound" latex increases the tank capacity by sixty per cent. without increasing the work, one marvels that the burden of inadequate tank capacity is ever tolerated.

Handling the Coagulum.

The manufacture of a satisfactory sheet from clean latex depends also for its success upon the handling of the coagulum. When the coagulation is completed the coagulum should be sufficiently soft and plastic to respond readily to even machining. A condition of affairs exists in many factories which is inimical to the successful handling of the soft plastic mass from the coagulating tank and its transporation to the sheeting battery. It is a matter of supreme importance to efficient manufacture to decide the optimum point at which the coagulum can be safely lifted and handled and yet be suitable for easy machining.

Recent developments in one of the large and up-to-date sheeting factories have shown the desirability of inserting a carrier or chute between the coagulating tank and the first machine. A simple device which has been found suitable is an aluminium trough of the same width as the coagulum, arranged on an incline to the first machine. A stream of water is maintained flowing down the trough. The pieces of coagulum when lifted from the tank to the trough slide unaided into the machine. By this means a soft and yielding coagulum can be successfully brought to a sufficiently compressed state to allow it to be handled by the machine coolly. Unless the coagulum is plastic and soft the rolled sheet will have thick edges and drying and smoking of the sheet will be delayed. When the sheet dries unevenly

it means that the coagulum has not been handled satisfactorily and experience shows that this is a fault which arises between the coagulating tank and the first machine and one that can be overcome by improved supervision.

The setting of the machine rolls depends to a great extent on the personal skill of the operator, but in view of its importance to the properties of the sheet every precaution should be taken to render this operation as fool-proof as possible. It must be remembered that one of the main objects of rolling the coagulum is to remove the serum, and unless the sheet is machined evenly and efficiently with simultaneous washing the tendency to defects such as rust, discoloured patches and mould will be increased.

The output of sheeting batteries has been made the subject of investigation by the Institute, and the results to date will be recorded in the next number of the Institute's Journal. The fact that some estate factories with three smooth machines and one marker with only one operator to each machine are now obtaining routine outputs of approximately 1300 lbs. dry sheet per hour indicates the economy to be derived from handling a wide sheet.

It is impossible for every factory with present facilities to develop an output of such magnitude, but the answers to a questionnaire addressed to a number of estates discloses a state of efficiency very far from ideal for much of the sheeting plant now in use.

The capacity of a machine depends on the width and thickness of the sheet treated and the number of feet of rubber rolled in a given time. It is doubtful whether such facts receive proper consideration. Apart entirely from the possible economy to be effected by running the available plant to full load, the appearance of the sheet and its freedom from many blemishes depends on the care and efficiency with which the sheeting is accomplished.

Drying and Packing.

One of the most important uses, and according to history the original use for which rubber was introduced to Europe, depends upon its characteristic of forming a waterproof surface. This characteristic should not be overlooked when we consider problems relating to the drying of sheet rubber.

When coagulum is compressed into sheet form we enclose water in a film of rubber and our ability to dry the sheet depends upon the efficiency with which we can withdraw the water from its waterproof jacket. For this reason the handling of coagulum and wet sheet should be undertaken with a view to retaining a porous or water permeable surface. It is the practice on almost all estates to drain the wet sheet before hanging it in the smokehouse. This draining should be carried out at a temperature which will not unduly harden the surface of the rubber and the removal of serum and serum solids by efficient washing should be regarded as a means to assist the ultimate removal of water, because it is known that the serum constituents of latex if allowed to remain in the sheet reduce the ease with which the water can be removed from warm rubber.

In the smokehouse itself cleanliness must not be forgotten. Having paid particular care to removing dirt from the latex and handling the coagulum under clean conditions it seems illogical to place the rubber in a building where little heed is paid to contamination with dust. In present estate practice it is very uncommon to dry rubber by means which exclude the undesirable products of combustion from entering the drying chamber. Much may be done on some estates to remove ash and dust before the hot gases gain access to the hanging sheet. This is a point where constant care and attention is required if unnecessary cleaning and cutting of the sheet afterwards is to be avoided.

The drying efficiency of a building depends upon the volume of air passing through the building and the difference in temperature between the incoming and the outgoing currents. It is important that the estate manager should make certain that full advantage is being taken of the space available by carrying out continuous observations on these points.

When the sheet has been dried and removed from the smokehouse it is necessary to sort, classify and pack it without delay. If due regard has been paid to the supervision of each stage of manufacture the sorting of sheet should be a mere matter of form; it is difficult to see what requires to be cut out of a finished sheet which has been made from clean latex handled throughout in a clean plant. On account of the introduction of accidental blemishes, however, sorting is always desirable, and this sorting should be carried out with the object of segregating all sheet which will not conform to market standards.

The value of a consignment depends upon the most inferior sheet in the lot and, although it sounds an exaggeration, there is every justification for penalising a consignment which contains one or two inferior sheets. A tyre is judged by the strength of its weakest spot, and it is useless for a manufacturer to rely upon the suitability of a parcel for tube manufacture if his somewhat rapid method of sampling discloses one portion of unsatisfactory rubber. The tube manufacturer finds that he cannot eliminate some kinds of dirt from rubber with any degree of reliability and consequently he penalises the whole consignment.

Packing should be resorted to as soon as possible in order to avoid any contamination of the finished material. Sheet which has been well prepared and carefully handled is still liable to develop defects if it is allowed to remain exposed to the moist air of the tropics, and although a consignment cannot be immediately marketed it is desirable to remove it from contamination at the earliest opportunity.

Conclusion.

The above indicates in a brief manner some of the outstanding points which should be observed by those interested in the preparation of standard sheet rubber of high quality at the present time. Factory practice is undergoing rapid and continuous changes. Undoubtedly a time will arise when the engineer and the chemist will have succeeded in transforming the old familiar estate factories into up-to-date establishments of modern machinery, but whether the plant of the

future will be driven electrically and succeed in producing a perfect sheet of rubber continuously in a few hours from the time the latex is received, or whether the latex will be transformed directly into completely finished rubber articles, the fundamentals will remain the same and the success of the operation will depend upon cleanliness and care; and whatever future developments may occur in the preparation of estate rubber for the market it is vital for the producer to remember that when any product is in excess of requirements the consumer sets the standard of quality. Non-conformity with such standards simply means no sales.

MINERALS AND NUTRITION

BY

Lt. Colonel H. A. REID, O.B.E., F.R.C.V.S., D.V.H., F.R.S.E.

The influence of nutrition in preserving the health of the body has long been recognised. It had been observed that impoverishment from whatever cause increases susceptibility to disease, and that both parasitic and microbic infections single out as their victims the poorly nourished.

The subject of nutrition was originally regarded solely from the aspect of digestion and assimilation. The body was assumed to be analogous to an engine which required so much combustible material for purposes of oxydation, and the aim was to adjust the amount of food to the energy requirements of the individual. A well balanced diet was one which contained an appropriate supply of proximate principles of definite caloric value. Although analysts of the early nineteenth century had turned their attention to the ash constituents of plants in relation to nutrition it is only in comparatively recent times that the vital importance of this aspect of the question has received serious consideration.

The study of certain hypothetical constituents known as accessory food factors, or vitamins as they have come to be known, has demonstrated that chemical analysis does not determine the actual nutritive value of foodstuffs. There are intangible properties which may not be revealed but which nevertheless are of extreme importance to the well being of the living organism. The fact that the human subject can maintain for an indefinite period vigorous health by the consumption of fruit juices alone, indicates that there are substances present which cannot be estimated in terms of heat units. It has recently been reported that sheep which had access to oranges maintained far better condition than others fed in the ordinary way.

It has been realised of late that the inorganic elements of foodstuffs are of as much importance as the organic constituents. Absence or insufficiency of certain mineral salts in an assimilable form is the cause of the so-called deficiency diseases which prevail in certain countries or localities throughout the world. It is doubtful even now whether the significance of an adequate mineral content is universally recognised by dieteticians. Yet in countries where the origin of obscure pathological conditions has been carefully investigated, these, in many instances, have been found to depend upon soil and hence plant deficiency in one or other of the mineral salts.

The valuable work accomplished by bacteriologists in determining the immediate cause of disease has, to a large extent, overshadowed the equally important though more remote question of nutrition in relation to susceptibility. We have to realise that a tissue immunity is dependent upon metabolic activity which will ensure an adequate supply of inorganic elements to the tissues and body fluids.

The observation that grazing animals will normally seek and devour those portions of the pasture richest in minerals illustrates the possession of an instinctive desire to absorb mineral matter and a recognition on their part that pastures

low in minerals are generally deficient also in protein. It is interesting to note that verminous infestations are frequent among livestock on mineral deficient pastures.

It is not unreasonable to assume that the beneficial effects of water from certain sources is probably due to their mineral content in solution which supplies essential elements to those who derive benefit from "cures" undertaken at spas. The universal desire for table salt suggests that sodium and chlorine may be deficient in the ordinary regimen of the human subject. It has been observed too, that cattle where "pica" and brittle bone diseases are prevalent develop the habit of licking themselves and their fellows apparently to obtain salt present in the skin excretions. Urine sodden earth may also be consumed, doubtless from the same motives.

The contention that salt acts as a hormone to the secretion of hydrochloric acid in the digestive juices is not supported by experimental evidence. Deprivation of salt merely leads to a conservation of sodium chloride obtainable from foodstuffs accompanied by a lowered excretion of sodium and chlorine without influencing the amount of hydrochloric acid present in the stomach.

The above premises lead us to the consideration of the more important mineral elements indispensable to nutrition. Chief among these must be placed calcium and phosphorus. These are present in all vegetation although their distribution is irregular, corresponding with the species of plant constituting the pasture and the nature of the soil upon which it is grown. Legumes are richer in minerals than grasses, while, on the other hand, grasses contain more phosphorus though less calcium than the legumes. It is important therefore, from a practical point of view, to see that the proportion of grass to clover is maintained more especially since clover always tends to displace grass. The modern European practice of feeding concentrates to dairy cattle is open to the objection that these vegetable concentrates contain an excess of phosphoric acid over the lime, and as these salts combine disproportionately to form bone, the excess of phosphoric acid tends to denude the body of its calcium.

In those countries or localities where a notable deficiency of phosphorus occurs livestock are frequently subject to the development of abnormalities proceeding from this cause. In South Africa, Theiler and his colleagues have traced a number of deficiency diseases affecting principally the bones, to this source, and similar observations have been recorded elsewhere. In India, New Zealand, and Australia, calcium and phosphorus deficiencies account for many obvious abnormalities occurring among grazing stock and may probably be responsible for others which are not so strikingly visible. In the last named country, Sedden in New South Wales has observed that ruminants depastured on phosphorus deficient land, are prone to consume the carcasses of dead animals and in this way they get infected with *Bacillus botulinus* and die from an acute toxæmia accompanied by paralytic symptoms. In order to maintain the calcium equilibrium of the blood and soft tissues, the lime salts, in the event of a calcium deficiency in the food supply, are absorbed from the skeleton. In consequence,

complaints denoted by fragility and deformation of the bones occur. Osteomalacia is frequent among sheep kept under these conditions, and the disease known as Osteoporosis of equines appears also to depend primarily upon a calcium-phosphoric acid deficiency.

Climatic conditions materially affect the mineral content of herbage. Thus in arid regions or during prolonged periods of drought the percentage of phosphorus is lower, and conversely, the lime content tends to be higher. This seasonal variation in the amount of the mineral salts present in the herbage explains to some extent the prevalence of nutritional diseases in certain countries or localities.

The application of fertilisers to poor land has the effect of diminishing the loss of minerals and at the same time conserving the soil moisture. In experimental plots treated with various fertilisers it is noticeable that the treated plots by comparison with the controls or untreated portions remain in better heart and keep greener during prolonged periods of dry weather.

India and parts of Australia from whence animal products including bone manure have been exported, have become notoriously poor in those mineral elements which have been extracted from the soil through generations of grazing. In countries whose commerce largely consists in the exportation of products derived from animals, the necessity to replace the loss of mineral matter by the application of suitable fertilisers is often neglected. In consequence, the livestock, although they may not show definite signs of suffering from this deficiency, sooner or later gradually decline in size and stamina and their development is retarded. This appears to be a natural attempt to limit their absorption of mineral salts through the assertion of the law of rapid development demanding an abundance of nutritive elements. Where pedigree stock have been introduced into countries with the object of grading up native herds, these retrogressive characters are very noticeable. The progeny resulting from the mating of the imported stock with the indigenous species fail, after a time, to thrive and are more susceptible to disease. They have, in fact, inherited the physical attributes of the imported parent without the advantage of an adequate food supply containing the due proportion of mineral matter necessary for the larger and more rapid development resulting from the cross.

In the Border Counties of England and Scotland a wasting disease known locally as "pining" or "vinqish" is prevalent among sheep, and a similar if not identical disorder occurs in certain areas of the north island of New Zealand where it affects both cattle and sheep. For many years the nature of this malady baffled those engaged in the work of investigation until an exhaustive comparative analysis of the soil and herbage from affected and healthy country revealed a shortage in the former of soluble iron.

"Bush Disease," as it is termed in New Zealand, appears on land of volcanic origin which is largely composed of pumice and the débris of lava. Iron is present in the form of an insoluble silicate which renders it unavailable for plant life. Ruminants grazing on such land consequently become affected with a

progressive anaemia causing them to waste away and finally succumb often amidst a luxuriant growth of pasture. In the earlier stages of the trouble a cure can be effected by the administration of a soluble salt of iron such as the double citrate of iron and ammonium. Cultivation and the application of phosphatic manures assist in eliminating the disease from the affected territory. Young stock can be fattened on 'bush sick' land but they cannot be maintained there for more than a few months without a change to healthy country. Another similar complaint is met with in East Africa under the name "Nakuruities" from the district where it exists. It has probably the same etiology as the New Zealand disease—absence of iron in an assimilable form. It is interesting in this connection to note that recent work has demonstrated the importance of copper in haemoglobin synthesis. In the absence of copper anaemic conditions are liable to occur. Copper is found principally in the liver. The investigations in New Zealand did not determine any insufficiency of copper in the viscera of even advanced cases of the iron hunger complaint.

An explanation of the immunity enjoyed by horses grazed on land short of iron and certainly fatal to ruminants may be found in their slower development rendering their need for mineral salt absorption less urgent.

Among the most interesting of the inorganic elements concerned in nutrition iodine occupies a prominent place. Iodine is present in all herbage in fractional amounts which may be so minute that refined methods of chemical analysis have to be employed in estimating the iodine content of pastures, hay, and other animal foodstuffs. The amount varies, corresponding with the iodine content of the soil.

Although the normal requirements for iodine appear to be very low, a deficiency gives rise to profound pathological changes chiefly connected with the functions of the thyroid gland which is the iodine storehouse of the body. Thyroxin, a secretion of the thyroid gland, contains normally 66 per cent. of iodine. The grave effects following on iodine shortage are witnessed in various parts of the world, notably in certain States of America, Canada, Australia, New Zealand, Africa, Palestine, and many parts of India. Mexico, Brazil, and the Argentine also suffer in this respect.

In iodine deficient countries both human beings and animals are liable to develop goitre and its concomitants denoted by general unthriftiness, hairlessness, and a tendency to malformation of the progeny of the iodine starved parent stock. But the development of diseases dependent upon thyroid insufficiency is by no means the only influence which this element exercises. It is also concerned, probably through its action on the parathyroids, with the body metabolism, which determines the equilibrium of blood phosphorus, nitrogen, and calcium. Livestock which do not obtain an adequate amount of iodine are less resistant to infections and intoxications of all kinds. Their productivity is lowered and they become generally less profitable.

The natural distribution of iodine is very erratic. Some districts are by comparison richly supplied, while in others there may be little or none. More-

over, cultivation and the application of artificial fertilisers and even animal excreta tend in time to exhaust the iodine content of the soil.

In all the older cultivated countries, as well as in many of those more recently developed, there is probably an iodine shortage which though not in itself sufficient to produce gross pathological changes, is nevertheless responsible for some of the obscure conditions met with in relation to grazing stock, such as partial or complete sterility, malnutrition, and lowered vital resistance. Most urban populations suffer from iodine deficiency through the almost universal habit of consuming only cooked food.

The ultra-violet rays of sunlight are known to promote the absorption of the mineral elements from food, especially calcium and phosphorus, and similar properties are attributed to vitamin "D" found in cod-liver oil. Iodine also shares in calcium and phosphorus metabolism, and it is quite likely that the iodine content of cod-liver oil influences mineral absorption in this way.

It follows from the preceding remarks that all cases of obscure origin occurring among animals at pasture should be investigated from the point of view of mineral assimilation and that analyses of the soil and herbage should be undertaken as a routine procedure. Iodine incorporated in mineral licks, or, according to circumstances, administered individually as potassium iodine, may be regarded as frequently helpful. The application of the iodiferous Chilean nitrate of soda as a fertiliser likewise suggests a practical procedure in cases suspected to depend upon an iodine shortage in the soil or foodstuffs of the locality.

Abstracts.

PROGRESS REPORT OF THE RICE CULTIVATION COMMITTEE OF MALAYA.

The following is an Abstract of the Progress Report of the above Committee which was published in the local press in November, 1930. The Committee was appointed by H. E. The Governor for the purpose of collecting evidence concerning the present position of the rice growing industry in Malaya and to make recommendations regarding future policy in local rice production. The Director of Agriculture is Chairman of the Committee.

In examining the present position of rice production in Malaya all the principal rice growing areas have been visited and a number of witnesses, up to date amounting to 90, have been examined.

It is the view of the Committee that it is impossible to put forward reliable recommendations until the situation throughout Malaya has been thoroughly examined. The conclusions summarised hereunder must therefore be regarded as tentative.

No very definite policy has hitherto been adopted in Malaya concerning local rice production. Two schools of thought on the subject may be said to have existed. The first maintained that the prosperity of Malaya depended on the cultivation and production of export staples and that, while reasonable help and encouragement should be forthcoming for rice cultivators, rice cultivation was of comparatively small importance to the country inasmuch as with a satisfactory market price for export staples, the country had always been in a position to purchase supplies required from outside on more favourable terms than those on which they could be produced in Malaya. The second held that the domestic food supply was of vital importance to the country and that dependence on imported supplies of rice was a source of danger, as in the event of an acute fall in the price of export staples or a shortage in the available export excedent of rice in foreign countries or both, a grave crisis might quickly arise. This condition actually arose during the rice shortage of 1919—21 and in order to cope with this the Government sustained a loss of forty-two million dollars, while further losses to employers must have been considerable. At the present time the slump is similarly affording a demonstration of the truth of this point of view.

The general distress resulting from existing economic conditions does not extend to those areas and to those communities which produce sufficient rice to meet their requirements.

It is agreed that in favourable years pecuniary profits resulting from rice cultivation are lower than those obtained from the cultivation of such crops as rubber and coconuts, but it must be remembered that little has been done to encourage the cultivation of rice, to improve its production or to enhance the possibilities of gain therefrom. In these circumstances it is desirable that all possible steps should be taken to improve matters so that when the market improves for export staples, rice cultivation may be maintained in competition therewith under better conditions than have hitherto obtained.

The following is a summarised statement of the findings of the Committee up to the present time.

1. The cultivation of padi is almost entirely in the hands of Malays, the average size of holding varying between 2—7 acres.
2. Statistics of areas are more reliable than those concerning crops. The following figures can therefore only be accepted as approximate—
Straits Settlements 68,000 acres yielding 20,690,000 gantangs of padi;
Federated Malay States 171,400 acres yielding 32,500,00 gantangs of padi;
Unfederated Malay States 412,000 acres yielding 83,300,000 gantangs of padi.
3. In order to afford a sound basis for improving the industry, more accurate statistics concerning production are essential. It is noted that steps in this direction are already being taken.
4. Figures of yield are unreliable, there being a universal tendency to understate yields. In consequence it is impossible to gauge the effects of any measures that have been undertaken for the improvement of padi cultivation.
5. The Malay population is more nearly self-supporting than has been supposed. The per capita consumption of rice by the non-Malay population is therefore higher than was thought. It is probable that the effect of the present slump will be a marked reduction in the imports of rice as it is likely that in times of prosperity the consumption is unnecessarily high. The present slump will probably result in an extension of the area cultivated.
6. The cultivation of padi by Malays is largely traditional; the commercial aspect is therefore to some extent of secondary importance to the Malay.
7. The cost of cultivation ranges from \$30—\$70 per acre. This divergence is accounted for by the facts stated in the previous paragraph and by the continuance of uneconomic methods of cultivation. A reasonable figure of cost of production by present methods is \$35 per acre.
8. Considerable divergencies as between the different States exist in relation to tenure of padi land. Where rules exist, steps can be taken to ensure the observance of prescribed dates of planting. This provision is essential to ensure control of pests and proper regulation of water supply.
9. Padi yields vary considerably, depending on the nature of the land cultivated, water supply and its control and methods of cultivation. Large areas of land exist in Malaya that are suitable for the cultivation of padi, and the best lands compare favourably with those which are to be found in any other part of the world.
10. Padi lands may be classified as—(a) continuous areas in the coastal alluvial plains, (b) small scattered areas in inland districts in the base of valleys or separated by ranges of hills and (c) situated on the banks

of large rivers. The first two are the most important, the third being less promising owing to liability to floods.

11. Improvements in water control are essential. These are divided into two classes, viz. large scale schemes in alluvial plains that can only be carried out by Government, and separate small schemes that can be undertaken by Government or the cultivators or a combination of the two. This latter alternative is recommended and has been operated in some instances.
12. In relation to the larger schemes, the need for drainage works is frequently quite as great as for irrigation. Many areas could be improved by this means while other areas could be rapidly developed by the adoption of such schemes.

As a preliminary careful studies and surveys are necessary, the provision of which is at present lacking. These matters must be considered on a geographical and not a political basis.

In reviewing the present constitution of the Hydraulic Branch it is pointed out that Malaya possesses no staff of Engineers which is exclusively concerned with irrigation; in the Straits Settlements the staff of the Public Works Department is inadequate to deal with irrigation questions, a reason for the abandonment in many instances of work on the problems of water control. In the Unfederated Malay States no provision exists with the exception of Kedah where an Irrigation Engineer is stationed. More extensive provision for irrigation works and for studies and surveys is essential.

13. It is considered that the possibilities of irrigating padi land by pumping where storage works are not feasible should be fully investigated.
14. Regarding the alleged shortage of water in the Krian irrigation scheme, there seems to be good reason to believe that the provision of large scale storage of water has led to wasteful methods of utilisation on the part of the cultivators, and that this wastage could be checked by the exercise of more rigid control in the distribution.
15. In relation to irrigation questions in different padi areas, the general principle is strongly advocated of forming standing committees comprising the administrative authority of the District, the Agricultural authority of the State and the Engineer in charge of Irrigation operations. The establishment of such sub-committees would result in the problem receiving more intelligent and closer attention from the officers chiefly concerned and would ensure co-operation and continuity.
16. To guard against past experience, the general line of policy in the future for the alienation of land for padi cultivation should be that land should not be alienated for cultivation under other crops, except after careful consideration.
17. The potential padi land in Malaya, not already alienated is probably 600,000 to 1,000,000 acres. The desirability for reconnaissance and

reporting on little known or practically unknown areas in respect of their suitability for padi cultivation is mentioned.

18. The Committee is not yet in a position to report on the most suitable means to be adopted for the development of potential padi areas.
19. In all probability the most suitable method of increasing production is by means of cultivating the land with modern machinery. Provided that efficient methods of water control are available, this method presents no insuperable difficulties.
20. The Department of Agriculture has, during the past ten years, carried out successful work in the direction of selecting and breeding improved strains of padi. These strains have become disseminated to a considerable extent in some districts. The system of trying out improved strains by means of test plots and by co-operative demonstration plots belonging to cultivators and also the scheme for the establishment of definite distribution centres for the sale of selected padi seed is approved by the Committee. It recommends that the system should be put into working order as early as possible and that any additions to staff which the scheme necessitates should be provided.
21. The establishment of efficient agricultural services in the Unfederated Malay States is essential if padi production and general agriculture is to be improved.
22. Padi producing areas may be classified under two heads: (a) areas which produce sufficient padi to meet the needs of the inhabitants and also to export the surplus production and (b) areas which only produce sufficient padi for the domestic needs of the cultivators themselves. In the latter case no economic problems respecting markets arise. In the former, questions of marketing are of considerable importance.
23. The maintenance of the Bagan Serai Government Rice Mill is considered essential in order that prices may be regulated on a fair basis.
24. Throughout the padi producing regions, debt amongst small cultivators is widespread, the percentage of indebtedness varying from about 40 to 90 in different areas. The system of advancing money to cultivators has been shown to be a failure.
25. The belief is expressed that in the widespread extension of co-operative principles lies the solution of this trouble, and steps should therefore be considered towards this end.
26. Consideration should be given to the possibility of imposing a small import cess on imported rice, the proceeds of which should be devoted to the improvement of irrigation and to experimental and other work having for its object the improvement of the industry generally. Several other points have been considered by the Committee which it is hoped to discuss in the Final Report.

RICE CULTIVATION IN ITALY*

The area under rice cultivation in Italy is approximately 370,500 acres, a figure that is unlikely to increase. It is estimated that 90—95 per cent. of this land is situated in the North of Italy. All the padi is grown on irrigable land and there is an ample supply of water.

There are less than twenty varieties of rice grown in the country, the maturation period of these varies from 5 to 5½ months. The Rice Experiment Station at Vercelli imports varieties which are distributed after trials and acclimatization tests.

In the main rice-growing area, a seven year rotation of crops is practised viz: wheat, meadow land, meadow land with casual maize and transplanted padi followed by four years of padi cultivation.

Before ploughing, farm-yard manure is applied in varying quantities up to 16—17 tons per acre. The land is then ploughed and on some farms, when the tractor is used, the harrow is attached to the plough and both operations carried out at the same time. Tractors are employed on the large farms. On the smaller farms ploughing is done by means of horses and oxen. Where farm-yard manure has not been applied, artificial manure is applied at the time of sowing at the following approximate rate per acre,—superphosphate 710 lbs., potassic manure 265 lbs., and if the crop requires it 90 lbs. sulphate of ammonia after weeding.

The soil is then harrowed a second time and irrigation commences. After 4—5 days the soil is well mixed by means of a puddling machine drawn by a tractor or horses and then levelled by hand implements.

The seed for sowing is selected by an effective and popular machine.

It is estimated that 25 per cent. of the total rice area is transplanted. Transplanting machines have been tried but are not popular. The seed is sown by machine on large farms and broadcast on small farms. The type of sowing machine has been evolved after considerable experience, is efficient and very popular. The rate of sowing is 135 lbs. per acre. Thinning out is done by machine and hand. Weeding is effected with a horse-drawn machine where a drill has been employed, otherwise hand-weeding becomes necessary.

The water is drawn off about two to three weeks before harvesting commences and clover is sown (*Trifolium incarnatum*.) The padi is harvested with the sickle, machines not having been successful.

The crop is threshed by means of a threshing machine. The small farmer gets his crop threshed by means of an itinerating threshing machine. About 3,520 lbs. can be threshed in an hour. The grain is then winnowed and dried.

Only one crop of padi per year is grown. The yield per acre for the 1930 crop was estimated, on an average, at 2—3 tons equivalent to 100 to 120 bushels per acre.

* Abstracted from an article by F. Burnett, M.C., M.A., (Oxon) in *The Agricultural Journal of British Guiana* Vol. III No. 3, Sept., 1930.

The proportion of rice to padi is 63—65 per cent. and the remainder is made up of 20 per cent. husks, 9 per cent. broken rice and 6 per cent. meal. The husks are used as firing material, the broken rice is generally converted into beer and there is also a market for the meal.

There are no co-operative buying or selling institutions in operation for this crop. Both the padi and the rice are sold to private stores which may be found in every large rice-producing district of the North of Italy.

EXPORT OF RUBBER FROM THE N.E.I. DURING SEPTEMBER AND OCTOBER, 1930.*

The export of plantation rubber was, as regards Java and Madura, considerably higher in September and October than in the same months of the previous year, viz. in September and October 1930, respectively 6,480 and 6,412 tons as against 5,154 and 5,180 tons in the same period of 1929. As in Java and Madura, the export of plantation rubber from the Outer Provinces was higher, viz. 8,424 tons in September, 1930 as against 7,605 tons in September, 1929. The export of native rubber at 7,030 tons however, remained considerably behind that of September, 1929 at 11,277 tons.

According to cables received from the Outer Provinces, it appears that the export of native rubber in October again shows a considerable fall for the principal ports.

Export of rubber in metric tons :—

	Djambi		Palembang		Bandjermasin		Pontianak	
	1929	1930	1929	1930	1929	1930	1929	1930
September	2377	1889	1566	695	2360	1368	1214	995
October	2064	1556	1457	608	2551	1065	1403	1007

* Translated from "Korte Berichten" of November 28th, 1930.

Reviews.

Reports of Technical and Divisional Officers of the Ceylon Department of Agriculture for 1929.

August, 1930, Ceylon Government Press, Colombo.

The Reports are to hand of the Technical and Agricultural Officers of the Ceylon Department of Agriculture for 1929, and as on the previous occasion are issued as two separate volumes.

The Technical Reports give an account of the various research activities of the Department; of these particular interest centres in the Report of the Economic Botanist which deals chiefly with breeding and selection work on padi. Mr. Lord stresses the influence of environmental factors on the yield of selected strains and points out that unless high yielding pedigree selections find conditions more or less similar to those under which the selections are made the results are disappointing. This does not altogether parallel experience in Malaya, but it seems likely that padi fields in Malaya are of naturally higher fertility than in Ceylon. It is also recorded that tests were made with varieties of padi from California but that none showed promise.

Some 415 selections were made during the year, while 372 previous selections were discarded. Manurial experiments were continued and indicated that under certain conditions phosphoric acid was a controlling factor. In relation to the application of green manure, it is concluded that on land which carries two crops of padi a year an application of green material is essential. On land carrying one crop the application of material other than that which naturally grows on the land may not be necessary except on sandy soils.

In the entomological section a lengthy account is given of the continuation of the work on termites. This work has already yielded useful results. In the agricultural section of the work a number of new host plants are recorded, while further progress is reported in relation to the bionomics of the pest.

In the Chemical Division report the principal line of investigation is concerned with green manures and their effects on soil conditions. Minor investigations, inter alia, have been concerned with soil erosion, soil fertility on Chena cultivation and nitrate removal in Peradeniya soils. It is, however, somewhat surprising to find that no work has apparently yet been undertaken on the systematic survey of the soil types occurring in Ceylon.

Mycological work has been apparently chiefly of a routine nature; an interesting addition to the reports of the Mycological and Entomological Divisions are the accounts given of the plant pest inspection work.

The Divisional agricultural reports are full of interest and comprise an account of much useful work accomplished. A record of a great deal of work done at the various experiment stations is given; a divisional centre has been established in the South Western District thereby bringing the scheme for the

establishment of agricultural centres a stage nearer completion.

The Farm Schools at Peradeniya and Jaffna continued operations while a new Farm School was opened in the Southern District towards the end of the year.

Cotton and tobacco purchase schemes continued to be operated successfully in the Southern and Northern Division respectively, while considerable activity was displayed in connection with village agricultural competitions and the like.

Rural co-operation, which is under the charge of the Department, apparently made satisfactory progress.

Occasion has previously been taken to comment on the soundness of the organisation for extensional work in Ceylon and the report appears to give further evidence of the correctness of this view.

H. A. T.

Durability of Malayan Timbers.

BY

F. W. FOXWORTHY, Forest Research Officer, F.M.S., and H. W. WOOLLEY,

Formerly Assistant Forest Research Officer with

A Note on Termites

By H. M. PENDLEBURY, F.M.S. Museum.

Malayan Forest Records No. 8, 60 pp. 6 pls. Printers Ltd., Singapore, 1930.

Price \$1.00 or 2s. 6d.

The differences of opinion on the durability of Malayan timbers led the authors to carry out—over a period of ten years—a series of simple and practical tests of the resistance of a large number of untreated Malayan timbers to insects and decay, and to compare such woods with well-known foreign woods subjected to similar tests. The results are stated in tabular form showing the woods destroyed in 2½ years or less and the performance of woods which were not destroyed in 5 years. Notes are also given of the detailed results of the 114 kinds of Malayan wood tested.

The conclusions are most important. The authors find that under the conditions of the tests fungus attack is of relatively minor importance, the wood usually being destroyed mainly by insects and that no wood tested was immune to the attacks of termites. Furthermore, hardness does not prevent insect attack, although pieces of wood containing sapwood were destroyed more quickly than those that were all heartwood. A list is given of thirteen timbers which

resisted attack for five years and may therefore be considered durable.

The second series of tests was concerned with the performance of timber surface treated with preservatives. Twenty-five preservatives were subjected to the test, three varieties of timber being used in each case. It will be realised that surface treatment cannot give anything like so long a period of protection as a thorough impregnation, in consequence of which the results of this work are somewhat inconclusive.

Sixteen preservatives gave perfect protection for one year, but their behaviour after the first year was various. With one exception all the satisfactory preservatives were of an oily nature. The authors conclude that there was nothing finally or decisively in favour of any one of the preservatives. Some obviously did better than others but it would be unsafe to say that any particular preservative was the best. Insects were responsible for most of the damage, but fungi were present in quite a number of cases. The preservatives used, at any rate in a surface treatment, do not prevent fungus attack.

Advice is given on the care of buildings—both permanent and temporary or semi-permanent structures—to prevent damages from termites.

Mr. H. M. Pendlebury writes an interesting account of the life-history of termites, some notes on the species most commonly met with in this country and a list of the 76 Malayan species.

Attention is particularly drawn to the futility of treating timber after construction work is completed as the termites obtain access by the untreated ends.

Planters and others who are from time to time faced with the problem of the erection of estate and other buildings and so have to decide on the material to be used in their construction will find this account of great interest, while its adequate index should render it a convenient book of reference.

D. H. G.

Miscellaneous.

ENTOMOLOGICAL NOTES.

Fourth Quarter, 1930.

Coconuts.

During this Quarter, the investigation of the control and economic importance of *Tirathaba rufivena* Walk., the greater coconut spike moth, has been completed. The series of experiments consisted of (1) allowing the spikes to burst naturally and of (2) removing the sheath enveloping the inflorescences when the spikes were considered to be on the point of bursting. The fall of female flowers from each inflorescence was recorded weekly during periods varying from 8—12 weeks.

The figures for the five parallel series are as follow :—

(i) Burst Naturally.

		Female Flowers at commencement of experiment.	<i>Tirathaba</i> bored.	Fall from causes other than <i>Tirathaba</i> .	Flowers (Nuts) remaining.
Series I.	...	330	79	130	121
Series II.	...	1381	132	556	693
Series III.	...	501	60	329	112
Series IV.	...	524	66	323	135
Series V.	...	2090	117	1013	960
Total	...	4826	454	2351	2021

(ii) Opened Artificially.

Series I.	...	501	7	306	188
Series II.	...	1161	39	510	612
Series III.	...	574	6	446	122
Series IV.	...	481	16	303	162
Series V.	...	2118	7	1141	970
Total	...	4835	75	2706	2054

Considered on a percentage basis, these figures give the following result :—

		<i>Tirathaba</i> bored. per cent.	Fall from causes other than <i>Tirathaba</i> . per cent.	Flowers (Nuts) remaining. per cent.
Burst Naturally	...	9.41	48.72	41.87
Opened Artificially	...	1.55	55.97	42.48

This result shows a reduction of 7.86 per cent. in *Tirathaba* bored female flowers by the removal of the sheath just before the spike would have burst, but at the same time an increase fall of 7.25 per cent. from causes other than *Tirathaba* occurs whilst an increase of only 0.61 per cent. takes place in the nuts remaining.

The figures demonstrate that the number of nuts bored by *Tirathaba rufivena* Walk. is considerably reduced by the removal of the sheath but indicate that this reduction increases the fall from causes other than *Tirathaba* rather than augmenting the number of flowers remaining.

These experiments were carried out on two estates planted with dwarf coconuts and for these areas the figures undoubtedly suggest that this moth is of no importance in reducing the yield of coconuts.

The colossal fall of female flowers from causes other than *Tirathaba* on these experimental areas is so high that the question may well be asked: would approximately 57 per cent. of the female flowers have to be bored by *Tirathaba* caterpillars before any loss in the yield of coconuts through the agency of this insect takes place?

A paper giving the details of these series of experiments is in course of preparation and will be published in the near future.

In a recent paper* "An Historical Note on *Tirathaba rufivena* Walk. (The Greater Coconut Spike Moth) and its Three Parasites in Malaya," the writer missed the first reference in India. Mr. Bainbrigge Fletcher, Imperial Entomologist, informs me that the first reference was contained in his Report for 1917—1918 (Sci. Repts. Agric. Res. Ins., Pusa, 1917—18 p. 98) and runs as follows:—

"A caterpillar found boring into young coconut fruits in the bunch on the tree and causing the young fruits to drop off. An accumulation of frass webbed up with silk indicates the presence of the borer. This insect is apparently an undescribed species of *Tirathaba* (Pylalidae)." With that reference, the larva, pupa and moth are figured.

Nipah.

The first occurrence of an Anthomyiid fly, No. 7327 (v. Plate at end) preventing the development of the female inflorescence of the nipah palm was recorded. The fly lays its eggs generally in groups on the male flowers as soon as they appear and sometimes on the sheathing leaves as soon as they separate. The maggots on hatching feed upon the soft juicy male flowers and later, mining the male flower stalks, reach the peduncle of the female inflorescence. Where the damage is serious the entire development of the female inflorescence is arrested and with the peduncle ceasing to function the production of juice is inhibited.

Experiments for the control of this fly were conducted and the results of two, namely (1) covering the inflorescence with mosquito netting and (2) removing the male flowers before they appeared, gave very satisfactory results. By

* Corbett, G. H., Scientific Series, No. 3, 1930, Department of Agriculture, Straits Settlements and Federated Malay States.

the removal of the male flowers, although eggs were found laid on some of the enveloping leaves, no attacked male flower stems were recorded and therefore no female stalks, as this fly causes no direct injury to the female inflorescence. In so far that more juice is considered to be obtained from artificially pollinated female flowers than from naturally pollinated, the control of this insect by removing the male flowers is undoubtedly economically justified. The control of this insect is assured and the details for incorporating the method for its control in estate practice only require to be settled.

Oil Palm.

The caterpillar damaging the fruits of the oil palm to which reference was made in "Entomological Notes for the Third Quarter" has been identified as the larva of a species of *Tirathaba*. No further reports of its injury have been received during this quarter.

Padi.

The investigation on the control of the padi borer, *Diatraea auricilia* Dudg., by the egg parasite—*Trichogramma nanum* Zehnt.—has been continued. This parasite is propagated on the eggs of the grain moth, *Sitotroga cerealella* Oliv., in Kuala Lumpur and field observations over an area of 33 acres of padi are made at Parit Buntar. During the month of December, 500,000 parasitised eggs per diem were sent and distributed throughout the experimental area.

Leptocorisa acuta Thunb., "Pianggap," occurred in large numbers on an area of padi in Perak as soon as the flowering stage was reached. Catching by means of sticks, one end of which was immersed in a sticky solution consisting of castor oil and rosin, was recommended.

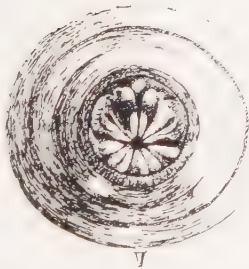
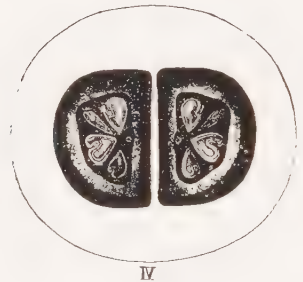
Tobacco.

Tobacco is not extensively grown in Malaya but enquires concerning *Gelechia heliopa* Low. from Malacca and *Psara submarginalis* Swinh. from Province Wellesley have been received.

The caterpillars of *G. heliopa* first mine the leaves and later the mid-ribs through which they reach the stem. Swellings are formed on the stem and, although pupation sometimes occurs in the mid-rib, it generally takes place within the galls. This insect can be a very serious pest to seedling tobacco. In the Dutch East Indies, nurseries are protected by covering them with mosquito netting early in the evening as the moths are not found on the wing during the day time.

The caterpillars of *Psara submarginalis* Swinh. are more frequently reported damaging the leaves of tobacco in Malaya. The plants may be protected by a 1 per cent. lead arsenate spray.

ANTHOMYIID FLY—A PEST OF INFLORESCENCE OF NIPAH.



Description of Plate.

I. Eggs (nat. size 1 mm.). II. Newly hatched maggot (nat. size 1 mm.). III. Full-grown maggot (nat. size 15 mm.). IV. Post. end of maggot. V. Ant. end of puparium. VI. Post. end of puparium. VII. Fly (nat. size, about 7 mm. long). Figs. (1), (2), (3), (4), (5), and (6) after Mr. K. Anthony, Fig. (7) after Che M. Razaly.

Tea.

The aphid—*Toxoptera aurantii* Boyer.—caused some damage to the young shoots of tea and the cricket, *Brachytrypes achatinus* Stoll., was reported cutting young seedlings and dragging them into their burrows. Heavy watering will drive these crickets to the surface. Digging is sometimes practised.

Coffee.

The coffee berry beetle borer (*Cryphalus hampei* Ferr.) has been reported from previously unrecorded coffee areas. A circular in English, Chinese and Malay has been distributed.

Miscellaneous.

Locusts and Grasshoppers.

No further reports of the presence of the locust—*Locusts migratoria*—have been received from the Tampin or any other area in Malaya.

Patanga succincta L.—the “Bombay” Locust—has been reported from Trengganu damaging hill padi. Individual specimens of this locust from time to time have been collected in Kuala Lumpur and other places in Malaya. The last reference is of an individual from Cameron’s Highlands. It is interesting to note that in the consignment of specimens adults as well as last instar nymphs were received.

Since prominence was given to the presence of *L. migratoria* in Malaya several species of grasshoppers have been forwarded. *Valanga nigricornis* Burm.—a large greenish grasshopper—has been forwarded on several occasions whilst *Catantops humilis* Serv. and *Catantops splendens* Thunbg. were abundant in Pahang where they damaged budded rubber.

“White Ants”

An unusual case of “white ants” causing damage to golf greens by covering the grass with a fairly hard, thin, even, compact layer of earth was reported. Wherever these ants had been noticed, patchy areas of unhealthy looking grass resulted. Spraying with a good quality of lead arsenate was recommended.

The degree of immunity of various woods to “white ant” attack has often been under consideration. The writer of these notes buried a piece of “chengal” or “chengai” (*Balanocarpus Heimii*) on the 12th. March, 1926, in a “white ant” nest. This piece of wood was unearthed and examined on various dates and on each occasion placed in different “white ant” nests. The last examination was made on the 29th. November, 1930, and on each occasion no injury was observed, although the wood was completely covered with “white ant” runs. It would appear that “chengai” is immune to “white ant” attack. “Cellactite,” a

roofing material, was buried on the 22nd. December, 1924, in a "white ant" nest and has withstood "white ant" attack up to the time of writing.

Ants in Bungalows.

Enquiries have been received concerning control measures for ants in houses. A mixture which is widely used in America has been found very satisfactory in Malaya for ridding bungalows and houses of several species of ants. The composition of the mixture is as follows:—

Water 11 pints; tartaric acid (crystallised) 7 grams; benzoate of soda 9 grams; granulated sugar 12 lbs.; honey (strained) 2 lbs.; sodium arsenite (chemically pure) $\frac{3}{4}$ oz.

This makes about $2\frac{1}{2}$ gallons of syrup. Probably about one pint will be found sufficient to free a bungalow from ants. The mixture is prepared as follows:—

Warm ten pints of water and when tepid add tartaric acid, then benzoate and then the sugar slowly while stirring to prevent burning. Slowly bring to boil and allow to simmer for about 35 minutes. Remove from the fire and add water to allow for evaporation. Stir in the honey before the mixture cools. Then add the sodium arsenite which has been dissolved in one pint of hot water and partially cooled.

This mixture is placed in shallow vessels about the houses or sponges which have been immersed in the solution are placed in tins with punctured lids.

G. H. C.

Departmental.

DEPARTMENTAL DISPLAYS AT AGRICULTURAL SHOWS.

At the Field Officers' Conference in 1929 the question of Departmental displays at Agricultural Shows was discussed. It was pointed out that these shows form an admirable means for disseminating information among the rural population, particularly among Malays. It was further pointed out that in order to make the work effective it was necessary that a definite plan of operation should be envisaged, and in consequence, it was decided that departmental displays should be divided into three classes, viz.—

- (a) Comprehensive displays to be staged at the main agricultural exhibition held in Kuala Lumpur;
- (b) Smaller, but nevertheless fully comprehensive, displays to be staged at important regional shows covering more than one district, such as the Taiping Show in the northern part of the Federated Malay States and the Seremban Show in the southern part of the Federated Malay States.
- (c) Smaller displays designed to illustrate particularly points for staging at District Shows.

It was further agreed that a comprehensive programme of exhibits should be drawn up and that for the smaller shows a standardised type of exhibit should be utilised in all cases. Moreover, as the information which it was desired to disseminate included all crops, and also, to an extent, agricultural co-operation, it was decided that the exhibits as far as possible should be in the nature of combined displays in which the Department of Agriculture, the Rubber Research Institute and, as circumstances permitted, the Co-operative Department should participate. This programme has been closely followed during the past season.

In all, seven Agri-Horticultural Shows were held, namely :—The Seventh Malayan Exhibition at Kuala Lumpur on the 19th—21st April; the Kedah Agricultural Show at Alor Star on the 10th and 11th July; the Negri Sembilan Agri-Horticultural Show at Seremban on the 25th and 26th July; the Malacca Agri-Horticultural Show at Malacca on the 26th July; the North Perak Agri-Horticultural Show at Taiping on the 24th August; the Pekan-Kuantan Show at Kuantan on the 26th August, and the Temerloh Agricultural Show at Temerloh on the 27th September.

Exhibits were staged at each of these Shows in accordance with the programme outlined above, and in the following paragraphs a brief account is given of details in connection with each.

It may be added that the policy adopted has proved markedly successful. It has been found possible to stage comprehensive exhibits illustrating a number of points and the result has been seen in the keen interest which has been shown in the exhibits by large numbers of persons attending the shows.

At all the above-mentioned Shows the Department of Agriculture displayed

exhibits of certain agricultural products of the country, together with their pests and diseases. European and other officers of the staff of the Department were in attendance at all the Shows and gave demonstrations and explained the exhibits.

The Malayan Exhibition.

At this exhibition, a large display was staged comprising oil palm and its products, tea, sisal hemp, tuba, yams and sugar palm products from the Government Experimental Plantation, Serdang. The work of the Department in relation to padi work was demonstrated by a collection in ear form, and also as clean rice of high yielding strains of padi which have been isolated and multiplied. Special features of the coconuts and copra exhibits shewed the common defects of copra caused by using under-ripe and over-ripe nuts, storage under wet conditions, insect attack and burning during drying.

The mechanical compositions of eight typical soils found in Malaya were shewn in long glass tubes with the percentages of the various constituents on cards. These were connected by means of streamers with a geological map shewing where the soils occur in Malaya.

Some of the more important insect pests of padi and of coconuts were staged by means of live and preserved specimens. Demonstrations were given daily of the breeding of parasites for the control of padi stem borers.

The rat pest was demonstrated by various exhibits shewing the damage occasioned by this pest and methods recommended for efficient control.

Diseases of oil palms, coconuts and tea were staged including stem rot of oil palms and fructifications of species of fungi which are possible causes of the diseases.

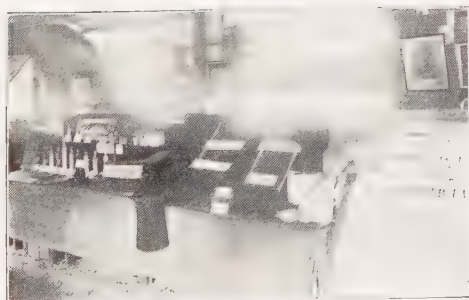
The Department exhibited a Large Black boar and sow and a Middle White boar and sow with two young Middle White pigs in the Pig Show.

In addition to the daily demonstrations given to the general public, special demonstrations were given by officers of the Department of Agriculture and the Rubber Research Institute to a large number of delegates and local headmen from different parts of Malaya who were attending a Conference of Rural Co-operative Credit Societies.

Explanatory cards in English and Malay, various leaflets in the vernacular and suitable maps and diagrams enabled visitors to appreciate the lessons to be learned from the exhibits of both Departments. The same system was adopted in displaying exhibits at all the Shows during the year. Publications of the Department in English, Malay and Chinese were also displayed for sale at this Exhibition and at all District Shows.

The Rubber Research Institute of Malaya staged a comprehensive series of exhibits in connection with rubber. These included all the important pests and diseases with methods of treatment. Budding operations, of which several demonstrations were given daily on the most satisfactory method of procedure in these operations, proved highly popular especially owing to the fact that many

THE MALAYAN EXHIBITION, 1930.



DEMONSTRATION EXHIBITS STAGED BY THE RUBBER RESEARCH INSTITUTE OF MALAYA.

were given entirely in Malay.

Factory methods adopted to produce a first class product were contrasted with methods producing an unsatisfactory product. All the phases of preparation of raw rubber from latex to the finished raw product in the form of sheet, crepe, sole crepe, preserved and concentrated latex were shewn, together with the various chemicals used in the preparation of rubber.

District Shows.

At the Kedah Agricultural Show the Departmental display occupied a space of 20 feet by 3 feet. The exhibits were arranged in sections, viz. strains of padi, rat destruction methods, copra and coconuts, tapioca and gaplek, pests of padi and coconuts and coconut diseases.

At this and other district shows, the Rubber Research Institute staged displays somewhat similar to the Kuala Lumpur exhibit but on a smaller scale. Exhibits were mainly concerned with the treatment of diseases of the rubber tree, the improvement of yield of latex by budding and the production and preparation of raw rubber.

Seremban and Taiping Shows. At the Negri Sembilan and Perak North Agricultural Shows held at the above centres the Department displayed exhibits illustrating oil palm cultivation, palm oils and their uses and high yielding strains of padi; faults in copra production with instructions for the improvement of the product; pests and diseases of padi, the coconut and oil palm; tea; and rat destruction by means of traps and poisoned baits. In Seremban an exhibit of soils was included similar to that displayed in Kuala Lumpur. This exhibit was omitted from the Taiping Show, but the rat destruction exhibits was more comprehensive at this centre, the making of poisoned bait being demonstrated.

The Rubber Research Institute staged exhibits similar to those at Kuala Lumpur, but on a smaller scale. At the Taiping Show an exhibit was provided consisting of representative soil profiles shewing jungle soil with its distinct humus layer, good estate soil with the humus layer still present, and bad, improperly managed estate soil with the humus layer absent. Samples of artificial manures as used on rubber estates were also exhibited.

Malacca, Kuantan and Temerloh Shows. At agricultural shows held at these centres the departmental exhibits were similar to, but on a smaller scale than, those put up at other shows. The Institute also displayed small exhibits embodying chiefly the scheduled diseases of rubber with identification and treatment, also the proper treatment of latex for the production of good rubber. Demonstrations of rubber budding were given at the Temerloh Show and proved of great interest.

At these smaller shows a particular attempt was made to interest the small-holder and in this both departments succeeded to a large degree.

FROM THE DISTRICTS.

The Weather.

There was a steady and well distributed rainfall throughout the month. This was sufficient in parts of Pahang to cause a minor flood at Pekan, but elsewhere there were only a few unimportant and local instances of damage to padi or other crops caused by deep water.

Remark on Crops.

Rubber.—There was a further slight improvement in the local prices given for rubber from small holdings, smoked sheet selling for \$14.20 and unsmoked sheet for \$9.15 per picul.

Mouldy Rot disease continued to be prevalent and its control required persistent attention from the inspecting officers.

Padi.—Prospects for this season's harvest continued to be satisfactory on the whole. Unfortunately, while fair to good yields are expected, the price of padi has fallen to the disadvantage of the large areas, such as those in Kedah and Krian, where the surplus padi for sale is produced.

Harvesting was commenced in parts of Kuala Kangsar and Batang Padang Districts of Perak and in Jelevu District of Negri Sembilan during the month. It was continued in many parts of Selangor and Pahang.

In Krian a number of additional areas damaged by *Sogatia furcifera* (*pallescens*) were found. Although the insect was widely distributed in the District, no large areas were damaged very severely, since the pest decreased in numbers soon after its presence had been rendered noticeable by the characteristic yellowing of the padi leaves. This insect disappeared from previously attacked areas in Kuala Kangsar District, but was reported from certain areas in Province Wellesley Central and the Dindings where the water had become stagnant.

Fruit.—In Province Wellesley good crops of durian, mangosteen, rambutan and machang were harvested during the month. A large crop of durians was harvested in Bukit Gantang Mukim of Larut District, while a fair crop of fruit of various kinds was obtained in Perak South. In Selangor the prospects for the fruit crop were reported to be poor, probably owing to heavy rains during the flowering period. In Klang and Kuala Langat Districts limited supplies of chiku, rambutan, pulasan, durian and jambu were available. In Pahang East also the fruit crop was maturing.

Pincapples.—In Singapore large supplies of fruit were available, but prices remained too low to allow for any reasonable profit to the grower.

Vegetables.—In Selangor there was a general decrease in both wholesale and retail prices for vegetables. This was believed to be due to some extent to large importations from China, which, owing to present exchange conditions, can be disposed of for prices below those of the local produce.

Notes on Demonstration Stations and Padi Test Plots.

Telok Chengai Padi Experiment Station, Kedah.—The growth of the padi was satisfactory. Attention was devoted to water control, weeding and the cutting out of plants not true to type. Local padi planters are evincing much interest in the work in progress.

Kuang Padi Test Plot, Selangor.—Considering the difficulties that have been experienced, especially with regard to damage by stem borers, the crop appeared satisfactory.

The Nachin variety which matured a month earlier than any of the other strains was completely destroyed by sparrows, so that no crop could be obtained.

Harvesting of the other strains commenced in the last week of the month. Owing to uneven ripening, reaping will be protracted.

Kuala Lipis Demonstration Station, Pahang.—One plot of groundnuts was planted. The tapioca trial plots were harvested and the varieties were classified for yield, ease of lifting and cooking qualities. The three best varieties were replanted to provide material for distribution.

Pekan Demonstration Station, Pahang.—Vegetable crops were lifted and the land was left fallow during the monsoon season. Some 100 marcots of eight different fruit trees were prepared.

Pineapple Demonstration Station, Singapore.—Clearing was completed and the pineapple and rubber plants were stacked, since burning was rendered impossible by the prevailing wet weather. Cultivation and fencing were commenced. Tenders were let and sites marked out for the buildings.

Plants Distributed.

Plants distributed from the Seremban Station included seedlings of six kinds of fruit trees, cuttings of tapioca and carpet grass and seeds of sweet corn and annatto. From the Kuala Lipis Station Brazil nut seedlings were distributed to eight school gardens in Temerloh District.

Rat Destruction.

In Province Wellesley payments were made for 220,021 rat tails, making the total collected during the year 1,514,928. In Krian rewards were paid for 34,055 tails during December and the total number of tails paid for and destroyed during 1930 was 1,791,790.

In spite of the very large number of rats destroyed a little damage to padi has been reported both in the Province and in Krian in fields adjoining patches of jungle or uncleared land, or the banks of irrigation canals, all of which afford cover for rats.

In practically all the States and Settlements the varying measures taken to arouse interest in the control of rats in padi fields have yielded useful results.

DEPARTMENTAL NOTES.

The Director of Agriculture, S.S. and F.M.S. was on duty in Singapore from 18th. to 21st. December, 1930.

Agriculture in Kelantan.

Mr. J. A. Craig, Agricultural Field Officer, Perak South, has been seconded for service in the State of Kelantan from December 8th. 1930.

Mr. Craig will make an intensive study of local conditions of cultivation and of local padi strains and in conjunction with the Administrative Officers, will collect statistical data regarding agriculture in that State. At the same time he will carry out, with the aid of the technical branches of the Department of Agriculture, S.S. & F.M.S. a detailed investigation of soil conditions throughout the rice-growing areas.

Kelantan contains a large Malay population and extensive areas of cultivated padi land. Crops, however, have of late years been insufficient to satisfy local requirements. The padi problem will therefore occupy first place in the programme of agricultural investigation in the State, although attention will also be given to subsidiary agricultural problems.

Transfer of Mr. Curtler.

Mr. E. A. Curtler, Assistant Agriculturist has been transferred to Perak South, as Acting Agricultural Field Officer. His head-quarters are at Tapah.

Vernacular Publications.

With the December issue, which has just been published, the Malay journal of the Department, *Warta Perusahaan Tanah*, completes its eighth year of publication. The circulation of this journal has steadily increased throughout Malay speaking countries. The amount of correspondence received from Malay agriculturists is evidence that the journal is widely read and appreciated.

The Chinese Agricultural Journal completes its fourth volume with the present number. Its circulation now nearly equals that of the Malay publication.

The Department is investigating the advisability of commencing a periodical in the Tamil language. One difficulty in this connection is to estimate probable circulation. The Director welcomes suggestions on this contemplated publication.

Government School of Agriculture, Malaya.

The buildings of the Government School of Agriculture at Serdang, near Kuala Lumpur are now practically completed. It will be remembered that the Foundation Stone was laid by H. H. The Sultan of Selangor on March 19th. 1930. The School will be opened in May, 1931.

The Prospectus of the School has been published and copies may be obtained on application to the Director of Agriculture, S.S. & F.M.S., Kuala Lumpur.

Statistical.

MARKET PRICES.

December, 1930.

Rubber.—The average price in Singapore was 14.3 cents per lb. against 14.2 cents in November. The average London price was 4.3d. compared with 4.4d. for the previous month. Prices for December have shewn a downward tendency.

Palm Oil.—London price on 23rd December was £16.12.6 per ton, F.O.B. on a basis of 18 per cent. F.F.A. The market seems to be losing its firmness and sellers are much more prominent.

Copra.—Singapore average prices for December: Sundried, \$6/-; Mixed, \$5.66; Cake, \$1.75 per picul. Corresponding prices in November: \$6.32½; \$6.00; \$1.75. Decline in prices has been steady following the easier tendency in consuming centres.

Gambier.—Supplies are small and demand is negligible. Average prices in December were; Block, \$9.37; Cube, No. 1, \$14.62 per picul against \$9.08 and \$14.25 respectively in November.

Cloves.—Zanzibar quoted at \$62 nom. Amboina \$63 to \$64 per picul.

Nutmegs.—Market rather firmer following a good demand from the Continent. Singapore average prices: 110's, \$25.37; 80's, \$31.25 per picul compared with \$26.87½ and \$31.12½ in November.

Mace.—Average Singapore prices: Siouw, \$73.50; Amboina, \$50.00 per picul. The corresponding averages for November were \$83.12½ and \$60.

Pepper.—Singapore, black, \$22.62½; white \$39.00; Muntok, white, \$40.50 per picul. Corresponding average prices for November were \$23.75; \$39.50; \$41.37½. Market has been steady, but the demand is poor.

Sago.—First half of December, prices were steady to firm on improved demand from Europe. Later there was heavy arrival with limited demand resulting in a rapid price decline. Average Singapore prices for December: Pearl, small fair, \$6.50; Flour, Sarawak fair, \$3.04, these averages being identical with those of the previous month.

Tapioca.—Market has been steady but quiet. Average prices for December: Flake, fair, \$4.65; Pearl, seed, \$5.71; Pearl, medium, \$6.50 per picul compared with \$4.47½; \$5.81; \$6.50 per picul in November.

Pineapples.—Demand has been poor but prices for most grades are unchanged. Singapore average prices for December were: 1½ lb. cubes, \$3.36 per case against \$3.28 in November; 1½ lb. sliced, flat, \$3.20 per case compared with \$3.18¾ in the previous month; 1½ lb. sliced, tall, \$3.47½ against \$3.65 per case in November.

The above prices are based on London and Singapore quotations for rubber and on the Singapore Chamber of Commerce Market Reports published in December, 1930. Palm Oil reports are kindly supplied by Messrs. Lewis and Peat (Singapore), Ltd.

1 picul = 133½ lbs.

The dollar is fixed at two shillings and four pence.

MALAYA RUBBER STATISTICS

STATES OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX HELD BY DEALERS AND ESTATES OF 100 ACRES AND OVER, THE DECLARED PRODUCTION OF THE SAME ESTATES, IMPORTS AND EXPORTS, AND THE ESTIMATED DOMESTIC CONSUMPTION OF RUBBER, FOR THE MONTH OF NOVEMBER, 1930. IN HRY. TONS.

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Class of Rubber	Federated Malay States	Singapore	Penang	Province Wellesley, Dindings, and Malacca	Johore	Total
2.)	21	22	23	24	25	26
Smoked sheet	8,566	16,560	2,657	2,346	990	31,119
(1000)	529	9,722	957	695	265	12,168
Unsmoked sheet	1,319	2,774	750	410	591	7,374
Scrap and lump	1,112				418	
Total all Grades	11,526	29,056	4,364	3,451	2,264	50,661

J. I. MILLER, M.C.S.,
Acting Registrar-General of Statistics, S.S. and F.M.S.

SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES, STRAITS SETTLEMENTS AND
KEDAH FOR THE MONTH OF NOVEMBER, 1930.

State	District	Acreage of padi land		Acreage planted		Percentage 4 - 3	Gross crop		Crop per acre 6 - 4	Remarks
		Acres (3)	Acres (4)	Acres (4)	Gantangs (6)		(7)	(8)		
Perak	Perak North :									
	Krian	53,250	...	...	...	...	...	...	...	About 47,050 acres planted.
	Larut	8,525	...	...	...	...	...	...	...	Planting almost completed.
	Selama	3,450	...	...	...	...	...	...	...	Do.
	Kuala Kangsar	13,997	...	13,797	...	...	...	...	...	Planting completed.
Selangor	Upper Perak	3,739	...	3,739	...	...	...	...	...	Do.
	Perak South :									Cultivation and transplanting in progress over about 13,000 acres—rest one to three months planted.
	8 Mukims	14,817	...	...	...	...	...	...	...	
		97,778	...	...	...	...	...	...	...	
	Ulu Langat	2,670	...	2,214	...	...	...	...	...	Harvesting commenced in Ulu Langat. Rest flowering.
Negri Sembilan	Kuala Lumpur	797	...	677	...	...	...	...	...	Harvesting commenced in K. Lumpur. Rest flowering.
	Ulu Selangor	1,205	...	1,013	...	...	...	...	...	Flowering.
	Kuala Selangor	18,564	...	...	...	...	...	...	...	Harvesting commenced in Jeram. Rest of the area is being transplanted excepting Sekenchau and Tanjong Karong—694 acres—which have been abandoned.
	Seremban	23,236	...	...	...	...	...	...	...	Flowering started excepting in Pantai, Lenggang and Ulu Beranang—2,356 acres.
	Kuala Pilah	4,904	...	...	...	...	...	...	...	About 5,000 acres tillering well—rest not yet flowering.
Negri Sembilan	Port Dickson	17,931	...	...	...	...	...	...	...	Not yet flowering.
	Jebebu	159	...	152	...	...	...	...	...	Flowering and fruiting—not yet ripe.
	Tampin	3,116	...	...	...	...	...	...	...	Gemas flowering but the others are not yet.
		2,609	...	...	...	...	...	...	...	Flowering.
	Rembau	7,897	...	...	...	...	...	...	...	
		36,616	...	...	...	...	...	...	...	

SUMMARY OF PADI REPORTS, FEDERATED MALAY STATES, STRAITS SETTLEMENTS AND
KEDAH FOR THE MONTH OF NOVEMBER, 1930.—(Continued.)

State	District	Acreage of padi land	Acreage planted	Percentage 4 - 3	Gross crop	Crop per acre 6 - 4	Remarks
(1)	(2)	Acres (3)	Acres (4)		Gantangs (6)	(7)	(8)
Pahang	Pahang West :						
	Temerloh	13,061	8,969	...	...	...	Harvest in progress. Area of plantable land revised.
	Raub	5,112	...	...	...	...	Harvesting commenced.
	Kuala Lipis	8,450	...	...	...	...	River mukims—6,750 acres—harvest in progress—rest up to 4 months planted.
	Bentong	1,126	872	...	...	...	Harvest commenced. Area of plantable land revised.
Straits Settlements	Malacca :						
	Central	15,723	14,931	...	...	...	Flowering commenced. Area of plantable land revised.
	Alor Gajah	11,136	10,337	...	...	...	do. do. do.
	Jasin	5,756	3,678	...	...	...	Transplanting almost completed.
		32,615	28,946	...	...	...	
	P. Wellesley :						
	North	18,560	...	...	...	...	Planted 2 months.
	Central	10,539	...	...	...	...	Do. 1 month excepting over about 1,500 acres.
	South	4,649	...	...	...	...	Planting not yet completed.
	Penang	33,748	...	...	...	...	
		4,000	...	...	...	...	Planting practically completed.
Kedah	Singapore	Nil	...	...	...	...	
	K. Star	105,060	...	...	...	...	
	Langkawi	4,908	...	...	...	...	
	P. Terap	6,637	...	...	...	...	
	Kubang Pasu	35,094	...	...	...	...	
	K. Muda	13,267	...	...	...	...	
	Baling & Sik	19,156	...	...	...	...	
	Kulim	3,642	...	...	...	...	
	Bandar Bahru	2,528	...	...	...	...	
	Yen	19,748	...	...	...	...	
		210,040	...	...	...	...	
							J. GORDON-CARRIE, Statistician.

N.B. The figures given in the latest return under Column 3 may be accepted as more accurate than any given in previous returns.

METEOROLOGICAL SUMMARY, MALAYA. NOVEMBER, 1930

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL							BRIGHT SUNSHINE						
	Means of		Absolute Extremes				At I foot	At 4 feet	Total	Most in a day		Number of days					Total	Daily Mean	Per cent	Length of Day	
			A.	B.	Min.	Max. and B						Precipitation*	Imm. or more	Thunder-storm	Thunder heard	Fog morning obs.					Gale force 8 or more
	°F	°F				°F	°F	°F	°F	in.	mm.										
		Max.	Min.	°F	°F	°F	°F	°F	in.	mm.	in.	mm.	in.	mm.	in.	mm.	hr.	hr.	%	hr.	
Railway Hill, Kuala Lumpur, Selangor	90.5	71.9	81.2	95	70	81	74	83.3	83.8	7.05	179.1	1.58	18	14	3	8	10	155.50	5.18	43	12.0
Bukit Jeram, Selangor	88.2	73.0	80.6	91	70	82	76	84.7	86.5	9.16	232.7	1.40	21	16	...	9	2	195.65	6.52	54	12.0
Sitiawan, Perak	88.4	73.0	80.7	91	71	84	75	84.1	84.6	5.32	135.1	1.90	21	17	9	16	1	175.00	5.83	...	...
Kroh, Perak	83.7	70.5	77.1	90	68	75	72	79.3	81.9	6.17	156.7	1.74	25	22	...	2	9	117.65	3.92	...	...
Temerloh, Pahang	87.3	72.5	79.9	92	70	79	74	83.4	85.1	8.36	212.3	4.30	19	15	2	20	7	142.45	4.75	39	12.0
Kuala Lipis, Pahang	87.2	71.4	79.3	91	69	78	73	82.5	83.7	9.88	250.9	1.90	20	18	14	16	24	137.00	4.57	...	...
Kuala Pahang, Pahang	85.1	73.8	79.5	90	71	77	76	82.6	85.3	18.53	470.7	6.11	21	18	5	10	1	167.00	5.57	46	12.0
Cameron's Highlands, Rhodendron Hill, Pahang	71.1	59.4	63.3	75	58	67	61	...	...	8.94	227.1	1.91	27	22	...	11	3	93.45	3.11	26	11.9
Cameron's Higlands, Tanah Rata	71.4	57.7	64.5	74	52	68	62	69.9	70.0	8.25	209.5	1.98	26	23	...	14	...	98.45	3.28	27	11.9
Fraser's Hill, Pahang	73.1	61.7	67.4	79	60	66	63	70.7	71.5	8.80	223.5	1.70	23	16	...	13	15	122.90	4.10	34	12.0
Mount Faber, Singapore	86.9	74.1	80.5	91	71	81	79	81.0	82.8	11.64	295.7	2.96	22	16	2	13	...	172.30	5.74	47	12.1
Butterworth, Province Wellesley	85.7	73.8	79.7	90	72	80	76	82.9	84.0	7.60	190.0	1.47	19	15	1	19	1	160.45	5.35	...	...
Bukit China, Malacca	84.7	73.5	79.1	88	71	81	76	82.5	83.9	6.66	169.2	1.23	18	15	...	5	...	174.60	5.82	48	12.0
Kluang, Johore	86.6	72.1	79.3	91	70	75	73	81.0	81.9	8.82	224.0	1.28	18	15	2	8	13	131.50	4.38	37	12.0
Bukit Lalang, Mersing, Johore	85.7	72.4	79.1	90	70	78	74	81.0	81.8	13.95	354.3	3.12	23	19	2	21	...	159.90	5.33	44	12.0
Alor Star, Kedah	86.3	73.6	79.9	91	72	77	75	84.8	85.8	4.92	125.0	0.69	20	15	...	5	2	141.25	4.71	...	...
Kota Bharu, Kelantan	84.0	73.3	78.7	90	71	74	75	82.6	84.1	37.61	955.3	5.18	25	23	...	5	...	113.45	3.78	...	...
Kuala Trengganu, Trengganu	84.2	72.7	78.5	90	70	73	75	80.5	81.9	42.17	1071.1	10.61	22	21	...	11	1	134.80	4.49	...	...

* Precipitation .01 inch or more when measurement is in inches .2mm. or more when measurement is in millimetres. Compiled from Returns supplied by the Meteorological Branch, Malaya.

